

NOTICES

OF THE

AMERICAN MATHEMATICAL SOCIETY

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Calendar of AMS Meetings and Conferences

This calendar lists all meetings and conferences approved prior to the date this issue went to press. The summer and annual meetings are joint meetings with the Mathematical Association of America.

Abstracts of papers presented at a meeting of the Society are published in the journal *Abstracts of papers presented to the American Mathematical Society* in the issue corresponding to that of the *Notices* which contains the program of the meeting,

insofar as is possible. Instructions for submission of abstracts can be found in the January 1994 issue of the *Notices* on page 43. Abstracts of papers to be presented at the meeting must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline given below for the meeting. Note that the deadline for abstracts for consideration for presentation at special sessions is usually three weeks earlier than that specified below.

Meetings

Meeting #	Date	Place	Abstract Deadline	Program Issue
895	† October 28–29, 1994	Stillwater, Oklahoma	Expired	October
896	† November 11–13, 1994	Richmond, Virginia	Expired	October
897	† January 4–7, 1995 (101st Annual Meeting)	San Francisco, California	Expired	January
898	* March 4–5, 1995	Hartford, Connecticut	December 1	March
899	* March 17–18, 1995	Orlando, Florida	December 1	March
900	* March 24–25, 1995	Chicago, Illinois	January 9	April
901	May 24–26, 1995 (Joint Meeting with the Israeli Mathematical Union)	Jerusalem, Israel	February 9	May
902	August 6–8, 1995 (97th Summer Meeting)	Burlington, Vermont	May 18	August
903	October 7–8, 1995	Boston, Massachusetts	July 24	October
904	November 3–4, 1995	Kent, Ohio	August 15	November
	November 17–18, 1995	Greensboro, North Carolina	August 15	November
	January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		
	March 22–23, 1996	Iowa City, Iowa		
	April 13–14, 1996	New York, New York		
	April 19–21, 1996	Baton Rouge, Louisiana		
	October 5–6, 1996	Lawrenceville, New Jersey		
	November 1–3, 1996	Columbia, Missouri		
	January 8–11, 1997 (103rd Annual Meeting)	San Diego, California		
	May 2–4, 1997	Detroit, Michigan		
	January 7–10, 1998 (104th Annual Meeting)	Baltimore, Maryland		
	March 27–28, 1998	Manhattan, Kansas		

* Please refer to page 1011 for listing of special sessions.

† Please refer to the Table of Contents for further information.

Conferences

January 2–3, 1995: Short Course on Coding Theory, and Short Course on Knots and Physics, San Francisco, California
 June 25–July 27, 1995: Joint Summer Research Conferences in the Mathematical Sciences, University of Washington, Seattle, Washington
 July 9–29, 1995: AMS Summer Institute on Algebraic Geometry, University of California, Santa Cruz, California
 July 17–August 11, 1995: AMS-SIAM Summer Seminar in Applied Mathematics on the Mathematics of Numerical Analysis: Real Number Algorithms, Park City, Utah

Other Events Cosponsored by the Society

October 8–14, 1994: Symposium on the Legacy of Norbert Wiener: A Centennial Symposium, Massachusetts Institute of Technology, Cambridge, Massachusetts
 October 16–18, 1994: Women in Probability Workshop, Cornell University, Ithaca, New York
 November 17–20, 1994: MER Forum Workshop on Preparation for Teaching Mathematics: Issues, Policies and Programs, Southern University, Baton Rouge, Louisiana
 November 27–December 3, 1994: Norbert Wiener Centenary Congress, Michigan State University, East Lansing, Michigan

Deadlines

	January Issue	February Issue	March Issue	April Issue
Classified Ads*	November 8, 1994	December 8, 1994	January 5, 1995	February 2, 1995
News Items	November 3, 1994	December 5, 1994	December 30, 1994	January 30, 1995
Meeting Announcements**	October 31, 1994	November 30, 1994	December 27, 1994	January 25, 1995

* Please contact AMS Promotions Department for an Advertising Rate Card for display advertising deadlines.

** For material to appear in the Mathematical Sciences Meetings and Conferences section.

NOTICES

OF THE

AMERICAN MATHEMATICAL SOCIETY

ARTICLES

905 1994 AMS Steele Prizes

The 1994 Steele Prizes were presented at the Minneapolis Mathfest in August. This year's recipients are Ingrid Daubechies, Louis de Branges, and Louis Nirenberg.

913 International Affairs: Events over the Past Year Spur Debate about the Role of the U.S. Mathematical Community in the International Arena

Over the past year, debate about the U.S. National Committee on Mathematics has rippled through the community. Allyn Jackson examines the issues surrounding the controversy and other aspects of the international role of the U.S. mathematics community.

917 Preparing for a Job Outside Academia *Stan Benkoski*

With the job outlook for mathematicians remaining less than promising, many on the job market would like to explore the opportunities available to mathematicians in industry. This article presents practical and philosophical advice about getting information on this sector of the job market.

921 Education Reform From a National Perspective: The Mathematics Community's Investment and Future *Hy Bass*

How can this country insure lasting, substantive reform in mathematics education? This article, based on a speech presented at a calculus workshop, presents an insightful, thought-provoking appraisal of the problems and potential of the reform movement.

FEATURE COLUMNS

927 Computers and Mathematics *Keith Devlin*

This month's column begins with the fifth in the series of George Grätzer's articles on \TeX . Then Raj Markanda reviews the latest version of *Mathcad* for Windows and Larry Riddle reports on *TEMATH*, Version 1.5.

934 Inside the AMS

Ivar Stakgold, former SIAM president, has taken the position of head of the AMS Washington Office, and he is full of ideas for strengthening the presence of mathematics in the nation's capital. Also included in this month's column is a list of non-user-specific electronic addresses for the AMS.

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Stillwater, OK

October 28–29, 1994

Richmond, VA

November 11–13, 1990

San Francisco, CA

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NOTICES

OF THE

AMERICAN MATHEMATICAL SOCIETY

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SUBSCRIPTION INFORMATION

Subscription prices for Volume 41 (1994) are \$146 list; \$117 institutional member; \$88 individual member. (The subscription price for members is included in the annual dues.) A late charge of 10% of the subscription price will be imposed upon orders received from nonmembers after January 1 of the subscription year. Add for postage: Surface delivery outside the United States and India—\$15; to India—\$28; expedited delivery to destinations in North America—\$32; elsewhere—\$67. Subscriptions and orders for AMS publications should be addressed to the American Mathematical Society, P.O. Box 5904, Boston, MA 02206-5904. All orders must be prepaid.

ADVERTISING

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From the Executive Director . . .

AMS BUSINESS—NOT AS USUAL

One of the major tasks that will face the next AMS executive director is insuring that the financial foundation of the Society remains sound during times of rapid and uncertain change. This is the business side of the Society, and it is anything but business as usual.

The current annual operating budget of the AMS is over \$21 million. There are over 250 employees located at five facilities: three in Rhode Island, *Mathematical Reviews* (*MR*) in Ann Arbor, and the AMS Washington office. The AMS has a complete in-house publishing operation (acquisition, editorial, composition, typesetting, printing, promotion, customer services, warehousing, and distribution), accounting for the large number of staff. Publication-related revenue accounts for nearly 75 percent of all AMS revenue, while dues account for approximately 9 percent, and meetings less than 5 percent.

Electronic delivery of information is rapidly changing the way new scholarly information is being communicated, thereby transforming the role of the scholarly publisher. This not only affects the primary AMS journals (the *Notices*, the *Bulletin*, the *Journal of the AMS*, *Proceedings*, and *Transactions*) but also bodes dramatic changes for *MR*, which accounts for over 40 percent of AMS publication revenue. Despite the uncertainty of these changes, the AMS sits in a particularly attractive position to contribute in a major way to the future of communication of mathematics.

The Society is well prepared to move into electronic delivery of information. It has invested in T_EX as a standard for electronic formatting and information delivery, has been offering the *MR* database electronically for nearly a decade, and has been preparing to deliver its journals electronically (including many years of back issues). More importantly, the Society can index and organize information useful to mathematicians, serving as an "information center for the mathematical sciences—a gateway to the mathematical literature". *MR* is the principal instrument for this purpose. *MR* must change, but the anticipated changes will add more value to its service to the worldwide mathematical community. e-MATH, the Society's electronic node on the Internet, can provide access to sources of information and a haven for those of us who do not aspire to be "Internet surfers".

There are also exciting plans for primary publications. AMS journals are being organized as databases of articles prepared for electronic as well as continued paper delivery. This new philosophy, however, anticipates that much of prepublication preparation (which used to be a major role of the publisher) will be placed upon authors, with distribution becoming primarily electronic and printing on paper an option of the end user. Provision of a broader family of electronic products, including electronic specialty journals and CD-ROM, is under serious review by the AMS.

Recent strategic planning has determined that the AMS should be an active book publisher, resulting in plans to greatly expand the book program. The Society's publication program now boasts full-time acquisition editors, a presence in bookstores throughout the world, and a broader list of titles (including graduate text and exposition series and a series in history of mathematics). This program calls for new emphasis on lower prices and more expertise in marketing and promotions.

In order to meet these new challenges, the Society has reorganized the administration of its publication activities. *MR* now reports to the central AMS administration. The Publication Division in Providence is now under the direction of the publisher, with Acquisitions, Electronic Products and Production, and Marketing and Sales all having directors reporting to the publisher.

These are exciting and challenging times—anything but business as usual. Meeting the challenges in publication and insuring a sound financial foundation for the Society are major tasks for the Society and the next executive director.

William Jaco

Letters to the Editor

One Consequence of the 1972 AMS Resolution

I was asked to chair the AMS Committee to Select Hour Speakers at Eastern Section Meetings by AMS President Ronald L. Graham.

After I had assumed that post, my attention was called to the AMS 1972 statement (appended below) and the manner in which it is being implemented by certain individuals in the AMS.

I then sent an e-mail message to the Committee instructing them to ignore irrelevant characteristics of candidates. In particular I used only first initials and last names in listing the candidates to remove first name gender clues. I urged the Committee members to vote for the various candidates based only on the descriptions of each candidate's major work provided by the nominees. My action was incidentally counter to the 1972 resolution, with which I disagree fundamentally.

As a result of my action, I was presented with the alternative by the AMS Council either to recant my objection to the 1972 resolution or to resign as chair of the Committee. The very fact that I was given this ultimatum shows that the 1972 resolution is taken more seriously than one might believe.

The note below is my response to their ultimatum, except that it is slightly edited—in particular, an individual, explicitly named in my original letter, who is vigorously implementing the resolution, is not named here because the dispute is with the 1972 statement itself, which does in fact condone the actions taken by the individual.

I fully support the goal of recruiting more women and minorities in our profession. This goal should be pursued by encouraging them to consider mathematics in the early stages of their careers and by creating a non-discriminatory atmosphere that will help them achieve this goal. I also agree that this country

is not doing its best in terms of creating such conditions. An example of that is the lack of child care centers which effectively discriminates against women and is a national disgrace.

However, I disagree with the notion that the work of a mathematician should be judged taking into account race, gender, or other factors unrelated to the work itself. Such policies will corrupt the standards of the profession, and cloud the reputations of those women and minorities who can succeed without such political advantage.

As a reviewer or an editor, I do not lower my standards for certain groups of authors. A theorem is a theorem regardless of who proved it. The 1972 statement could be extended to this arena as well. Is the AMS next going to require editors and referees to take anything other than mathematical merit into account, and to have the society include more papers by women and minorities in AMS journals?

This would be consistent with the 1972 statement. Will authors be asked to submit with their manuscripts a questionnaire about their race, sex, national origin, religion, sexual preference...? (Perhaps I shouldn't put ideas into anyone's head!) The same standard that applies to acceptance of papers, should apply (as it always has) to appointing hour speakers for AMS meetings.

I have spent a half-life fighting discrimination and am not about to start discriminating now to support a program naive in the extreme in attempting (counter-productively, I believe) to cure social evils by artificially redistributing recognition by the mathematical community. I simply cannot accept this part of the 1972 statement and the way it is being implemented. I cannot recant and so I am forced to resign.

I believe that the end of this AMS policy will be to harm the strong people in each minority group by identifying everyone in the group with the weaker members who need discriminatory help in order to advance. The end is likely to be even worse than the means.

Here is the relevant part of the statement passed at the AMS Business Meeting on January 19, 1972 (I object to the

italicized words which are being interpreted as justifying a quota system):

“Resolved that:

1. The American Mathematical Society will work actively for equal opportunities for women in the following areas:

(a) employment at all levels: this will include the search for and recruitment of qualified women;

(b) advancement and tenure in academic positions;

(c) admissions to graduate schools;

(d) graduate and postdoctoral fellowships and assistantships;

(e) membership on advisory boards and panels; and

2. the Society *will include* more women on

(a) Society programs and panels, including invited speakers and section chairmen;

(b) committees and governing boards.”

Larry Shepp
AMS Member

(Received June 6, 1994)

AMS-fSU Aid Fund

Editors Note: Recently Dr. A. Bratus submitted a letter to the editors of *Rossiiskaya Gazeta* in response to an article that had appeared in that publication by Vladimir Tsekhanov, the director of the Economics Crimes Division of the Russian Federal Counterintelligence Service. The following is a translation

Letters to the Editor

Letters submitted for publication in the *Notices* are reviewed by the Editorial Committee.

The *Notices* does not ordinarily publish complaints about reviews of books or articles, although rebuttals and correspondence concerning reviews in *Bulletin of the American Mathematical Society* will be considered for publication.

Letters should be typed and in legible form or they will be returned to the sender, possibly resulting in a delay of publication. All published letters must include the name of the author. Letters which have been, or may be, published elsewhere will be considered, but the Managing Editor of the *Notices* should be informed of this fact when the letter is submitted.

The committee reserves the right to edit letters.

Letters should be mailed to the Editor of the *Notices*, American Mathematical Society, P. O. Box 6248, Providence, RI 02940, or sent by e-mail to notices@math.ams.org, and will be acknowledged on receipt.

of this letter, which concerns the AMS program to aid Russian mathematicians. To the Editors of *Rossiiskaya Gazeta*:

On May 26 *Rossiiskaya Gazeta* published an article entitled "The Country on Sale. Wholesale and Retail", with the subtitle "Vladimir Tsekhanov, director of the Economic Crimes Division of the Federal Counterintelligence Service, ponders over the hostilities on the economic front". The author examines some of the problems the Economic Crimes Division deals with. Here we see the fight with smuggling of goods, with corruption, with banking crimes, with illegal arms sales, etc. Without any intention to disparage the importance of all these problems, we want to draw your attention to an example of "economic hostilities" presented in the article. We start with an exact quote from the article of Vladimir Tsekhanov. "For example, the Soros Foundation and the American Mathematical Society, through the Russian Academy of Sciences, addressed our mathematicians and asked them to send the scientific papers to U.S.A to be evaluated by American scientists. The thousand best authors will receive \$50 per paper. Just think about it: \$50 for information that might cost millions!"

We claim that all statements in the above piece are false. Neither the Soros Foundation, nor the American Mathematical Society, nor the Russian Academy of Sciences ever addressed our mathematicians with such a request. None of these organizations ever promised to pay to the thousand best authors 50 dollars—i.e., 50 pieces of silver.

Here are the facts. At the initiative of the chairman of the mathematics department of the Massachusetts Institute of Technology, well-known American mathematician Robert MacPherson, a request for voluntary donations was made in 1991 to American mathematicians worried by the catastrophic conditions of their colleagues in the U.S.S.R. Nowhere in the world are mathematicians rich people (although, according to V. Tsekhanov, the information in their papers might be worth millions), and the money raised by this call was not sufficient. The American Mathematical

Society, as a nongovernmental professional organization, asked George Soros personally (not to be confused with the Soros Foundation) to donate the remaining amount, and Soros granted this request. This made it possible to pay to about 400 mathematicians from the former Soviet Union a stipend of \$50 a month. In prices of 1991–1992 this was a substantial amount, which helped a lot of our mathematicians, most of them not very young people, to survive in this difficult time. The distribution of this aid was realized by a joint committee which included both American mathematicians and their colleagues from the FSU. We must emphasize that the aid itself was not restricted by any preliminary conditions. It was a purely humanitarian action of help to colleagues that was made possible by the personal initiative and selfless devotion of R. MacPherson and his American colleagues. One must have a certain talent for distorting the actual situation in order to present this noble action as an example of "hostilities on the economic front".

Either we see here once again the old tradition of searching for enemies or examples of "hostilities" that have to be dreamed up.

A. S. Bratus
V. P. Krainov

(Received by the *Notices* June 10, 1994)

The Harrison Tenure Case

Enough has already been said about the tenure case of Jenny Harrison, particularly in the March 1994 issue of the *Notices*. However, there are certain basic questions about this case which were never raised in the extensive discussion in the article by Allyn Jackson, nor were they alluded to in the letters of Marina Ratner and Morris Hirsch. Yet another one by Lenore Blum and Lisa Goldberg in the July/August issue of *Notices* deals with personalities. Nothing was mentioned about Harrison's teaching ability, her interaction with students and faculty in various disciplines, the extent and nature of involvement in curriculum development and reform.

The main focus of the debate was the quality of her research in comparison with some Fields medalists (mathematical equivalent of Nobel Prize winners).

There are fewer Fields medalists than Nobel Prize winners in any discipline in which it is awarded, except economics. If all the elite institutions (there are quite a few in this country, fortunately) decided to give tenure in mathematics only to Fields medalists or their equivalents, there would not be enough of them to meet such a requirement.

The University of California, Berkeley, is supported by the taxpayers of that state (and private funding). Those citizens deserve quality education which may be enhanced by, but is not totally dependent upon, the caliber of the research of their professors.

In this day and age, mathematics pervades the entire curriculum. In general, mathematicians do not earn high marks for their camaraderie with their colleagues in other disciplines. By ignoring other aspects of our work besides the merit of our published research, we create an ivory tower.

I fully appreciate the necessity of evaluation of published research of the faculty at the University of California, Berkeley, but some weight must be placed on teaching, involvement in curriculum development, and interaction with students and faculty, especially at the assistant professor level. My views are consonant with the recommendations of JPBM [Joint Policy Board for Mathematics] for Professional Recognition and Rewards as enunciated in the Guiding Principle IV (p. 34 of the report).

Many state institutions emulate UC, Berkeley; and if no consideration is given to the other criteria which I have mentioned, mathematics education at all levels will suffer.

Subhash C. Saxena
Coastal Carolina University
(Received June 13, 1994)

Employment and the National Policy Statement

We were pleased to see the National Policy Statement of the AMS (May/June 1994 *Notices*). For the most part, the statement does a good job addressing the issues that face the mathematics community today. In particular, we are glad that the AMS leadership is urging strong action to improve the job market.

We were disappointed, however, that the AMS is maintaining the reasoning that only two conditions, the retrenchment in academia and the influx of foreign mathematicians, are responsible for the job crisis.

However you look at the situation, the 50 percent increase since 1987–1988 in the number of Ph.D.s granted each year in this country (*Notices*, November 1993, p. 1170) has helped to create the problems in the job market. This increase happened largely because of faulty predictions of an impending shortage of Ph.D.s. As a result, there would be a crisis in the job market today (lesser, but a crisis all the same) regardless of world events. Thus we believe the 50% increase in the production of Ph.D.s is a major cause of employment woes for mathematicians.

In spite of the current employment crisis, we still see mathematicians arguing against reevaluating their university's Ph.D. program and its growth. Many of these mathematicians believe the job market will improve in the near future and thus argue that there is no need to reevaluate. Attributing the job crisis only to external factors, as does the National Policy Statement, encourages this view. Until we convince the entire mathematical community that the crisis

cannot be solved without reevaluating our programs, many of the goals of the policy statement will remain unfulfilled. This is one major reason that the internal causes of the employment crisis should be mentioned.

Additionally, if we hope for undergraduates to make informed decisions about whether or not to attend graduate school in mathematics, it is up to us to provide the information. This makes it important that the AMS publicize the oversupply of Ph.D.s produced in this country. Providing this information will encourage mathematics students, both graduate and undergraduate, to prepare for jobs in industry and other areas besides academia. Indeed, this would help fulfill the goal of facilitating "liaisons between academic and industrial mathematical scientists" (from Goal 2 in the National Policy Statement).

Another reason for mentioning the increase in Ph.D. production is that omitting it contributes to the frustration that junior mathematicians feel about the AMS and the job market. This omission also contributes to the appearance that the AMS is more concerned with protecting the interests of senior mathematicians than with helping junior mathematicians. We realize the AMS leadership does not wish to worsen their

position in making arguments for more funding from Congress and the NSF; but in a statement directed, in part, to the entire mathematical community, this unwillingness to admit that the mathematical community is partially responsible for the job crisis is unfortunate.

Finally, omitting the internal causes of the job crisis also takes away from the benefits of the National Policy Statement. The omission will cause some to pay less attention to the many important points in the statement. We do not mean to attack the leadership of the AMS, but rather to point out the need to publicize that we, the mathematical community at large, are responsible in part for the job crisis. Moreover, it is up to us to thoughtfully reevaluate our programs in light of the current situation. In conclusion, we hope that in future editions of the National Policy Statement the internal causes of the job market will be mentioned.

Curtis Bennett
 Editor, *Young Mathematicians
 Network (YMN)*
 Bowling Green State University
 (Received July 18, 1994)

This letter was also signed by seven other *YMN* editors and fourteen members of *YMN*. Some *YMN* editors chose not to sign the letter.

UNIVERSITY LECTURE SERIES

Volume 5

Topological Invariants of Plane Curves and Caustics

V. I. Arnold

This book describes recent progress in the topological study of plane curves. Arnold describes applications to the geometry of caustics and of wavefronts in symplectic and contact geometry. These applications extend the classical four-vertex theorem of elementary plane geometry to estimates on the minimal number of cusps necessary for the reversion of a wavefront and to generalizations of the last geometrical theorem of Jacobi on conjugated points on convex surfaces. These estimates open a new chapter in symplectic and contact topology: the theory of Lagrangian and Legendrian collapses, providing an unusual and far-reaching higher-dimensional extension of Sturm theory of the oscillations of linear combinations of eigenfunctions.

1991 *Mathematics Subject Classification*: 53, 57, 58
 ISBN 0-8218-0308-5, 60 pages (softcover), July 1994
Individual member \$18, List price \$30, Institutional member \$24.
To order, please specify ULECT/5NA

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ADD THIS COVER SHEET TO ALL YOUR ACADEMIC JOB APPLICATIONS

The Joint Committee on Employment Opportunities has adopted the cover sheet on the facing page as an aid to job applicants and prospective employers. The AMS Committee on the Profession also endorses its use. The current imbalanced job market has left employers overwhelmed with large numbers of applications to be processed, and job candidates who are justifiably frustrated with the lack of timely responses to their applications. Both sides should benefit from the increased efficiency that a standardized cover sheet will bring to application processing in Mathematical Sciences departments.

How to use this form:

1. Using the facing page or a photocopy, (or a T_EX version which can be downloaded from the e-MATH gopher on the “Professional Information for Mathematicians”/“Career Development Resources” menu), fill in the answers which apply to ALL of your academic applications. Make photocopies.
2. As you mail each application, fill in the remaining questions neatly on one cover sheet and include it ON TOP OF your application materials.

Mathematics Departments in Bachelor’s, Master’s and Doctorate granting institutions have been contacted and are expecting to receive the form from each applicant, along with any other application materials they require. Obviously, not all departments will utilize the cover form information in the same manner. It is hoped that this process will become a standard in the mathematical community and that in time further enhancements may lead to real improvement in the process of obtaining employment in the mathematical sciences. Please direct all general questions and comments about the form to dmm@math.ams.org or call the Professional Programs and Services Department, AMS, at 800-321-4267 extension 4105.

JCEO Recommendations for Professional Standards in Hiring Practices

The JCEO believes that every applicant is entitled to the courtesy of a prompt and accurate response that provides timely information about his/her status. Specifically, the JCEO urges all institutions to do the following after receiving an application:

- (1) Acknowledge receipt of the application—immediately; and
- (2) Provide information as to the current status of the application, as soon as possible.

The JCEO recommends a triage-based response, informing the applicant that he/she

- (a) is not being considered further;
- (b) is not among the top candidates; or
- (c) is a strong match for the position.

Academic Employment in Mathematics
APPLICATION COVER SHEET

This cover sheet is provided as an aid to departments in processing job applications. It should be included with your other application material. Please print or type. Do not send this form to the AMS.

Last (Family) Name: _____ Social Security Number: _____ - _____ - _____
Optional

First Name or Initial: _____ Second Name or Initial: _____

Address through June 1995 _____ Work Phone: (____) _____

_____ Home Phone: (____) _____

_____ E-mail: _____

Current Institutional Affiliation: _____

Country of Citizenship: _____ If not U.S. Citizen, type of visa:
 Permanent Resident Temporary Resident

Ph.D. received/expected: _____ Ph.D. Advisor: _____
Month Year

Source of Ph.D.: _____
Department Institution

Indicate the mathematical subject area(s) in which you have done research using the 1991 *Mathematics Subject Classification* printed on the back of this form. If listing more than one number, **list first** the one number which best describes your current primary interest. _____ Primary _____ Secondary

Give a **very brief** synopsis of your current research interests in the box below (e.g. finite group actions on four-manifolds.) Avoid special mathematical symbols and please do not write outside of the boxed area.

Indicate the position for which you are applying: _____

If unsuccessful for this position, would you like to be considered for a temporary position? Yes No
 If yes, please check the appropriate boxes. Postdoctoral Position 2+-Year Position 1-Year Position

List the names and affiliations of up to four individuals who will provide letters of recommendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.

- 1. _____
- 2. _____
- 3. _____
- 4. _____

1991 Mathematics Subject Classification

- 00 General
- 01 History and biography
- 03 Logic and foundations
- 04 Set theory
- 05 Combinatorics
- 06 Order, lattices, ordered algebraic structures
- 08 General mathematical systems
- 11 Number theory
- 12 Field theory and polynomials
- 13 Commutative rings and algebras
- 14 Algebraic geometry
- 15 Linear and multilinear algebra, matrix theory
- 16 Associative rings and algebras
- 17 Nonassociative rings and algebras
- 18 Category theory, homological algebra
- 19 K-theory
- 20 Group theory and generalizations
- 22 Topological groups, Lie groups
- 26 Real functions
- 28 Measure and integration
- 30 Functions of a complex variable
- 31 Potential theory
- 32 Several complex variables and analytic spaces
- 33 Special functions
- 34 Ordinary differential equations
- 35 Partial differential equations
- 39 Finite differences and functional equations
- 40 Sequences, series, summability
- 41 Approximations and expansions
- 42 Fourier analysis
- 43 Abstract harmonic analysis
- 44 Integral transforms, operational calculus
- 45 Integral equations
- 46 Functional analysis
- 47 Operator theory
- 49 Calculus of variations, optimal control
- 51 Geometry
- 52 Convex and discrete geometry
- 53 Differential geometry
- 54 General topology
- 55 Algebraic topology
- 57 Manifolds and cell complexes
- 58 Global analysis, analysis on manifolds
- 60 Probability theory and stochastic processes
- 62 Statistics
- 65 Numerical analysis
- 68 Computer science
- 70 Mechanics of particles and systems
- 73 Mechanics of solids
- 76 Fluid mechanics
- 78 Optics, electromagnetic theory
- 80 Classical thermodynamics, heat transfer
- 81 Quantum theory
- 82 Statistical mechanics, structure of matter
- 83 Relativity and gravitational theory
- 85 Astronomy and astrophysics
- 86 Geophysics
- 90 Economics, operations research, programming, games
- 92 Biology and other natural sciences, behavioral sciences
- 93 Systems theory, control
- 94 Information and communication, circuits

1994 Steele Prizes

Three Leroy P. Steele Prizes were awarded at the Minneapolis Mathfest.

These prizes, established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein, are endowed under the terms of a bequest from Leroy P. Steele.

Three Steele Prizes are awarded each year: one for expository mathematical writing, one for a research paper of fundamental and lasting importance, and one in recognition of cumulative influence extending over a career, including the education of doctoral students. The current award is \$4,000 in each of these categories.

The recipients of the Steele Prizes for 1993 are INGRID DAUBECHIES for the expository award, LOUIS DE BRANGES for research work of fundamental importance, and LOUIS NIRENBERG for the career award. The prizes were presented at the AMS-MAA opening banquet on August 14, 1994, at the Minneapolis Mathfest.

The Steele Prizes are awarded by the Council of the Society acting through a selection committee whose members at the time of these selections were Eugenio Calabi (chair), Vaughan F. R. Jones, Robert P. Langlands, Barry Mazur, Paul Rabinowitz, Marina Ratner, Jane Cronin Scanlon, Jean E. Taylor, and William P. Thurston.

The text that follows contains the committee's citations for each award, the recipients' responses, and a brief biographical sketch of each recipient.

Citation for Ingrid Daubechies

The expository award goes to Ingrid Daubechies for her book *Ten Lectures on Wavelets* (CBMS 61, SIAM, 1992, ISBN 0-89871-274-2). The concept of wavelets has its origins in many fields, and part of the accomplishment of Daubechies is finding those places where the concept arose and showing how all the approaches relate to one another. The use of wavelets as an analytical tool is like Fourier analysis—simple and yet very powerful. In fact, wavelets are an extension of Fourier analysis to the case of localization in both frequency and space. And like Fourier analysis, it has both a theoretical side and practical importance.

Daubechies' lectures have been important in educating the mathematical community about wavelets; many of us first learned about wavelets through hearing her speak. But

not that many people can be reached by any one lecture. The CBMS course format, with its week-long series of main lectures and its requirement that the lecturer produce a book, once again proves its worth, allowing a wider community to gain access. Daubechies' is an invaluable resource for the novice interested in learning about "The What, Why, and How of Wavelets", to borrow the title of the first chapter. It is entirely self-contained; if a desired result or application is not in the text, one is certain to find several references to where it can be found. It strikes an excellent balance between theory and application, effectively showing how each influenced the development and understanding of the other. The book also weaves in the history of wavelets, relating developments in disparate fields which converged to become wavelets.



Ingrid Daubechies

Daubechies has, of course, made major contributions to the subject herself. Haar wavelets (where the "mother wavelet" is the characteristic function on $[0, 1/2]$ minus the

characteristic function on $[1/2, 1]$ have been known since 1910; they were thought to be a curiosity but not very useful. With Daubechies' work, Haar wavelets have been shown to be the first in a whole family of compactly supported nonsmooth wavelets: beautiful examples of functions with fractal higher derivatives. This book contains original results of hers as well as presents previous work by her and others.

Biographical Sketch

Ingrid Daubechies was born on August 17, 1954, in Houthalen, Belgium. She received her Ph.D. from Free University, Brussels (1980). Professor Daubechies is presently a member of AT&T Bell Laboratories' staff (until December 31, 1994). In January 1995 she will assume the position of professor of mathematics at Princeton University.

Professor Daubechies has served on the AMS Short Course Subcommittee and on the AMS Committee on Committees since 1993. She has given numerous addresses, including the following: Invited Address, SIAM (Chicago, 1990); Principal Lecturer, CBMS Regional Conference (Lowell, 1990); Invited Address, MAA (Baltimore, 1992); Invited Address, AMS (Bethlehem, April 1992); and Organizer and Speaker, AMS Short Course on Wavelets and Applications (San Antonio, January 1993). She presented a Plenary Lecture at the International Congress of Mathematicians in Zürich in August 1994.

In 1992 Professor Daubechies was awarded a five-year MacArthur Fellowship.

Response from Ingrid Daubechies

I feel greatly honored that the AMS has chosen to award a Steele Prize to my work. When I set out to organize my CBMS lectures and later *Ten Lectures on Wavelets*, I wanted to convey the many links that exist between this new mathematical development and ideas in physics, electrical engineering, computer vision, and, of course, other fields in mathematics. The interaction with applications has been a constant source of inspiration for my own work, and I find it deeply gratifying that this mix of mathematics and applications is so well received.

Citation for Louis de Branges

It was observed by R. L. E. Schwarzenberger that mathematicians strive to be original but seldom in an original way. Louis de Branges is a courageous exception; his originality is his own.

The Bieberbach conjecture, formulated in 1916 and the object of heroic efforts over the years by many outstanding mathematicians, was proved by de Branges in 1984. The Steele prize is awarded to him for the paper "A proof of the Bieberbach conjecture" published in *Acta Mathematica*, **154** (1985), 137–152. The conjecture itself is simply stated. If

$$f(z) = z + \sum_{n=2}^{\infty} a_n z^n$$

converges for $|z| < 1$ and takes distinct values at distinct points of the unit disk, then $|a_n| \leq n$ for all n . Equality is achieved only for the Koebe functions $z/(1 + \omega z)^2$ where ω is a constant of absolute value 1.

The classical ingredients of the proof, the Löwner differential equation and the inequalities conjectured by Robertson and Milin, as well as the Askey-Gasper inequalities from the theory of special functions, are clearly described in the volume *The Bieberbach Conjecture* (published by the Society). So is the generous reception of the Leningrad mathematicians to the efforts of de Branges to explain it and their help in the composition of the eminently readable *Acta* paper.

The Milin inequality was known to imply the Bieberbach conjecture, and Löwner had used his technique in the 1920s to deal with the third coefficient. For de Branges it was of capital importance that, in contrast to the Bieberbach conjecture itself, the Milin and Robertson conjectures were quadratic and thus statements about spaces of square-integrable analytic functions. The key was to find norms for which the necessary inequalities could be propagated by the Löwner equation. de Branges constructed the necessary coefficients from scratch, solely on the basis of their required properties, thereby reducing the verification of the Milin conjecture (and thus of the Bieberbach conjecture) for a given integer n to a statement that was almost immediate for very small n , that could be verified numerically for small n , yielding many new cases of the conjecture, and that ultimately revealed itself to be an inequality established several years earlier by Askey and Gasper. The entire construction required a thorough mastery of the literature, formidable analytic imagination, and great tenacity of purpose.



Louis de Branges

The proof is now available in a form that can be verified by any experienced mathematician (either in de Branges' own paper or in that of Fitzgerald and Pommerenke [*TAMS*, **290** (1985), 683–690]) as analysis that is “hard” in the original aesthetic sense of Hardy—simple algebraic manipulations linked by difficult inequalities. Although the mathematical community does not attach the same importance to the general functional-analytic principles that led to them as their author does, it is well to remember when recognizing his achievement in proving the Bieberbach conjecture that for de Branges its appeal, like that of other conjectures from classical function theory, is as a touchstone for his contributions to interpolation theory and spaces of square-summable analytic functions. Without anticipating the future in any way, the Society expresses its appreciation and admiration of past success and wishes him continuing prosperity and good fortune.

Biographical Sketch

Louis de Branges was born on August 21, 1932, in Paris, France. He received his B.S. degree from the Massachusetts Institute of Technology (1953) and his Ph.D. from Cornell University (1957).

Professor de Branges began his academic career as an assistant professor at Lafayette College (1957–1959). He was a member of the Institute for Advanced Study (1959–1960) and then a lecturer at Bryn Mawr College (1960–1961). He was also a member of the Courant Institute of Mathematical Sciences (1961–1962). In 1962 he became associate professor of mathematics at Purdue University. He advanced to professor of mathematics the following year and has been a faculty member at Purdue University since that time.

Professor de Branges has been a member of the Committee to Select Hour Speakers for Western Sectional Meetings (1968–1969). He gave an Invited Address (Madison, November 1963) and spoke at the Summer Institute on Entire Functions and Related Parts of Analysis (San Diego, June 1966).

Professor de Branges was an Alfred P. Sloan Foundation Fellow (1963–1966) and a Guggenheim Fellow (1967–1968). In 1992 he was awarded the first Ostrowski Prize for mathematical achievement by the University of Basel. His fields of research interest are functional analysis, operator theory (including applications to system theory), polynomial approximation, special function theory (including related group representations), geometric function theory, analytic number theory (including representation theory and modular forms), set theory, and quantum mechanics. He has also been a reviewer for *Mathematical Reviews* and a translator of Russian.

Response from Louis de Branges

The Proof of the Bieberbach Conjecture in Retrospect*

This report begins with two acknowledgements. One is made to the American Mathematical Society for its continued

endorsement of research related to the Bieberbach conjecture. The Steele Prize is only the latest expression of its interest. It should be unnecessary to say that fundamental research cannot be sustained for long periods without the support of learned societies. The American Mathematical Society has earned a reputation as the world's foremost leader in fundamental scientific research.

Another acknowledgement is due to Ludwig Bieberbach as a founder of that branch of twentieth century mathematics which has come to be known as functional analysis. This mathematical contribution has been obscured by his political allegiance to National Socialism, which caused the mass emigration of German mathematical talent, including many of the other great founders of functional analysis. The issue which divided Bieberbach from these illustrious colleagues is relevant to the present day because it concerns the teaching of mathematics. Bieberbach originated the widely held current view that mathematical teaching is not second to mathematical research. As a research mathematician he exhibited intuitive talent which surpassed his more precise colleagues. Yet the proof of his conjecture is a vindication of their more logical methods [12].

The proof of the Bieberbach conjecture is difficult to motivate because it is part of a larger research program whose aim is a proof of the Riemann hypothesis. This research effort begins with the theory [1] of Hilbert spaces whose elements are entire functions and which have these properties:

(H1) Whenever $F(z)$ belongs to the space and has a nonreal zero w , the function $F(z)(z - \bar{w})/(z - w)$ belongs to the space and has the same norm as $F(z)$.

(H2) For each nonreal number w a continuous linear functional is defined on the space by taking $F(z)$ into $F(w)$.

(H3) The function $F^*(z) = \bar{F}(\bar{z})$ belongs to the space whenever $F(z)$ belongs to the space, and it always has the same norm as $F(z)$.

The theory of these spaces is related to the theory of entire functions $E(z)$ which satisfy the inequality

$$|E(x - iy)| < |E(x + iy)|$$

for $y > 0$. If $E(z)$ is any such function, write

$$E(z) = A(z) - iB(z)$$

where $A(z)$ and $B(z)$ are entire functions which are real for real z and

$$K(w, z) = [B(z)\bar{A}(w) - A(z)\bar{B}(w)]/[\pi(z - \bar{w})].$$

Then the set $\mathcal{H}(\mathcal{E})$ of entire functions $F(z)$ such that

$$\|F\|^2 = \int_{-\infty}^{\infty} |F(t)/E(t)|^2 dt$$

is finite and such that

$$|F(z)|^2 \leq \|F\|^2 K(z, z)$$

*Research supported by the National Science Foundation.

for all complex z is a Hilbert space of entire functions which satisfies the axioms (H1), (H2), and (H3). For each complex number w the expression $K(w, z)$ belongs to the space as a function of z , and the identity

$$F(w) = \langle F(t), K(w, t) \rangle$$

holds for every element $F(z)$ of the space. A Hilbert space, whose elements are entire functions, which satisfies the axioms (H1), (H2), and (H3), and which contains a nonzero element, is isometrically equal to a space $\mathcal{H}(\mathcal{E})$.

The aspect of these spaces which is now relevant is the remarkable interplay which exists between particular analytic functions and related spaces of analytic functions. When information about an analytic function is wanted, it is often obtainable from properties of a related space of analytic functions. This technique is applied in the proof of the Bieberbach conjecture and is expected to be applicable in a proof of the Riemann hypothesis.

Another example of such a relationship between isolated analytic functions and spaces of analytic functions appears in the factorization theory for functions analytic in the unit disk. Engineering language has displaced the original mathematical terminology in this field.

A linear system is a matrix

$$\begin{pmatrix} A & B \\ C & D \end{pmatrix}$$

whose entries are continuous linear transformations. The matrix acts on the Cartesian product of a vector space \mathcal{H} with scalar product, called the state space, and a vector space \mathcal{C} with scalar product, called the coefficient space. The Cartesian product is realized as column vectors with upper entry in the state space and lower entry in the coefficient space. The main transformation A maps the state space \mathcal{H} into itself. The input transformation B maps the coefficient space \mathcal{C} into the state space \mathcal{H} . The output transformation C maps the state space \mathcal{H} into the coefficient space \mathcal{C} . The external operator D maps the coefficient space into itself. The transfer function of the linear system is the power series

$$W(z) = \sum W_n z^n$$

whose entries are the operators defined on the coefficient space \mathcal{C} by

$$W_0 = D$$

and

$$W_{n+1} = CA^n B$$

for every nonnegative integer n .

The state space and the coefficient space are considered in the weak topology induced by self-duality. The linear system is said to be unitary if its matrix is unitary. And it is said to be conjugate isometric if its matrix has an isometric adjoint.

A canonical conjugate isometric linear system with transfer functions $W(z)$ is a conjugate isometric linear system

whose state space consists of power series with coefficients in \mathcal{C} and which has these properties: The main transformation takes $f(z)$ into $[f(z) - f(0)]/z$. The input transformation takes c into $[W(z) - W(0)]c/z$. The output transformation takes $f(z)$ into $f(0)$. The external operator is $W(0)$.

A canonical unitary linear system with transfer function $W(z)$ is a linear system whose state space consists of pairs $(f(z), g(z))$ of power series with coefficients in \mathcal{C} and which has these properties: The conjugate power series is defined by

$$W^*(z) = \sum W_n^- z^n$$

if

$$W(z) = \sum W_n z^n$$

where the bar denotes the adjoint of an operator on \mathcal{C} . The main transformation takes $(f(z), g(z))$ into

$$([f(z) - f(0)]/z, zg(z) - W^*(z)f(0)).$$

The adjoint of the main transformation takes $(f(z), g(z))$ into

$$(zf(z) - W(z)g(0), [g(z) - g(0)]/z).$$

The input transformation takes c into

$$([W(z) - W(0)]c/z, [1 - W^*(z)W(0)]c).$$

The adjoint of the input transformation takes $(f(z), g(z))$ into $g(0)$. The output transformation takes $(f(z), g(z))$ into $f(0)$. The adjoint of the output transformation takes c into

$$([1 - W(z)W(0)]c, [W^*(z) - W^*(0)]c/z).$$

The external operator is $W(0)$. Its adjoint is $W(0)^-$. Such a linear system is always unitary.

The theory of linear systems with finite-dimensional state space and coefficient space is a fundamental tool of the engineering community in this last half of the twentieth century. The mathematical community needs to revise its graduate teaching to include this fundamental concept. The mathematical treatment of the concept should however include infinite-dimensional state spaces and coefficient spaces. The required topological methods are due to Mark Krein.

The anti-space of a vector space with scalar product is the same vector space considered with the negative of the given scalar product. A Krein space is a vector space with scalar product which is the orthogonal sum of a Hilbert space and the anti-space of a Hilbert space. Krein spaces are the natural choice of state space and coefficient space for conjugate isometric and unitary linear systems.

An important special case of the theory of canonical conjugate isometric linear systems occurs when the coefficient space is the one-dimensional Hilbert space of complex numbers considered with absolute value as norm. If the state space is a Hilbert space, then the transfer function is analytic and bounded by one on the unit disk. A construction of such spaces is due to James Rovnyak and the author [18]. They also

obtain a related construction of canonical unitary linear systems whose state space is a Hilbert space [19]. These results recapture the starting situation in which a space of analytic functions is associated with a particular analytic function.

These constructions associate a Hilbert space, whose elements are functions analytic in the unit disk, with any given function $W(z)$ which is analytic and bounded by one in the unit disk. The function $W(z)$ is the transfer function of a canonical conjugate isometric linear system whose state space is the Hilbert space of analytic functions. There is also a related Hilbert space whose elements are pairs of functions analytic in the unit disk. The function $W(z)$ is also the transfer function of a canonical unitary linear system whose state space is the Hilbert space of pairs of analytic functions.

The proof of the Bieberbach conjecture is concerned with a special case of the theory of such canonical conjugate isometric and canonical unitary linear systems in which the transfer function W defines an injective mapping of the unit disk into itself having the origin as a fixed point. These properties of the transfer function are characterized by the existence of a new Hilbert space whose elements are analytic functions and a new Hilbert space whose elements are pairs of analytic functions. For every point w in the unit disk the expression

$$\log \frac{1 - W(z)W(w)^-}{1 - z\bar{w}}$$

is a function of z which is analytic in the unit disk and has value zero at the origin. The expression belongs to the space of analytic functions, and the identity

$$f(w) = \left\langle f(z), \log \frac{1 - W(z)W(w)^-}{1 - z\bar{w}} \right\rangle$$

holds for every element $f(z)$ of the space. For every point w in the unit disk the expression

$$\log \frac{1 - W(w)^-/W^*(z)}{1 - \bar{w}/z}$$

is a function of z which is analytic in the unit disk and which has value zero at the origin. The pair

$$\left(\log \frac{1 - W(z)W(w)^-}{1 - z\bar{w}}, \log \frac{1 - W(w)^-/W^*(z)}{1 - \bar{w}/z} \right)$$

belongs to the Hilbert space of pairs of analytic functions and the identity

$$f(w) = \left\langle (f(z), g(z)), \left(\log \frac{1 - W(z)W(w)^-}{1 - z\bar{w}}, \log \frac{1 - W(w)^-/W^*(z)}{1 - \bar{w}/z} \right) \right\rangle$$

holds for every element $(f(z), g(z))$ of the space. This characterization of the injective property is essentially due to Helmut Grunsky [7].

When $f(z)$ belongs to the Grunsky space of analytic functions, then

$$\exp f(z)$$

belongs to the state space of the canonical conjugate isometric linear system, and the inequality

$$\|\exp f(z)\|^2 \leq \exp \|f(z)\|^2$$

is satisfied. If equality holds, the identity

$$\langle \exp f(z), \exp u(z) \rangle = \exp \langle f(z), u(z) \rangle$$

holds for every element $u(z)$ of the Grunsky space of analytic functions. Whenever $(f(z), g(z))$ belongs to the Grunsky space of pairs of analytic functions, then

$$\langle \exp f(z), W^*(z)/z \exp g(z) \rangle$$

belongs to the state space of the canonical unitary linear system, and the inequality

$$\|\langle \exp f(z), W^*(z)/z \exp g(z) \rangle\|^2 \leq \exp \| \langle f(z), g(z) \rangle \|^2$$

is satisfied. If equality holds, then the identity

$$\begin{aligned} & \langle \langle \exp f(z), W^*(z)/z \exp g(z) \rangle, \\ & \langle \exp u(z), W^*(z)/z \exp v(z) \rangle \rangle \\ & = \exp \langle \langle f(z), g(z) \rangle, \langle u(z), v(z) \rangle \rangle \end{aligned}$$

holds for every element $(u(z), v(z))$ of the Grunsky space of pairs of analytic functions.

The proof of the Bieberbach conjecture makes indirect use of these exponential relations to obtain information about the coefficients of $W(z)$. The underlying problem is to characterize an initial segment of coefficients of the power series. The proof of the Bieberbach conjecture is complicated by the fact that the underlying problem remains unsolved. A direct use of the exponential relations is desired.

Difficult problems were left unsolved by the proof of the Bieberbach conjecture. Some of these have since been clarified. Progress has been made, for example, in the structure theory of canonical unitary linear systems and its applications to analytic function theory. Of particular interest is a generalization of the Beurling inner-outer factorization [17]. This result is the culmination of a series of publications on canonical unitary linear systems whose state space is a Krein space. They supplement a previous series on canonical unitary linear systems whose state space is a Hilbert space.

Progress has also been made towards the initial objective of a proof of the Riemann hypothesis [14]. The results are conjectured to be also relevant to the proof of the Bieberbach conjecture. A positivity condition has been found for Hilbert spaces of entire functions which is suggested by the theory of the gamma function [16]. The condition appears, for example, in the structure theory of plane measures with respect to which the Newton polynomials form an orthogonal set [22].

Results which are related to the present work have been obtained by Xian-Jin Li in his thesis [23]. An axiomatic treatment is given of the Szegő theory of polynomials which are orthogonal on the unit circle. A variant of the axioms (H1), (H2), and (H3) for Hilbert spaces of entire functions is used for this purpose. The results obtained are an application of the factorization theory for canonical conjugate isometric linear systems whose state space is a Hilbert space and whose coefficient space is a two-dimensional vector space with indefinite scalar product. A quantum positivity condition is introduced which adapts the theory of the gamma function to the unit disk. The ultimate objective of his work is a new proof of the Riemann hypothesis for function fields. A proof by the methods of factorization theory seems to be as difficult as it is for the classical Riemann hypothesis.

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Citation for Louis Nirenberg

The career award goes to Louis Nirenberg for his numerous basic contributions to linear and nonlinear partial differential equations and their application to complex analysis and differential geometry.



Louis Nirenberg

His first major work was his thesis on global differential geometry, in which he solved the long open Weyl problem of isometric embedding of surfaces of positive curvature in \mathbb{R}^3 .

Nirenberg is a master of the art and science of obtaining and applying a priori estimates in all fields of analysis. A minor such gem is the useful set of Gagliardo-Nirenberg inequalities. A high point is his joint research with Agmon and Douglis on a priori estimates for general linear elliptic systems, one of the most widely quoted results in analysis. Another is his fundamental paper with F. John on functions of bounded mean oscillation which was crucial for the later work of C. Fefferman on this function space.

Nirenberg has been at the center of many major developments. His theorem with his student, Newlander, on almost

complex structures has become a classic. In a paper building on earlier estimates of Calderón and Zygmund, he and J. Kohn introduced the notion of a pseudo-differential operator which helped to generate an enormous amount of later work. His research with Treves was an important contribution to the solvability of general linear PDEs. Some other highlights are his research on the regularity of free boundary problems with Kinderlehrer and Spruck, existence of smooth solutions of equations of Monge-Ampère type with Caffarelli and Spruck, and singular sets for the Navier-Stokes equations with Caffarelli and R. Kohn. His study of symmetry of solutions of nonlinear elliptic equations using moving plane methods with Gidas and Ni, and later with Berestycki, is an ingenious application of the maximum principle.

In addition to his own research, Nirenberg has had over forty Ph.D. students. His boundless enthusiasm and encouragement have served as an inspiration to several generations of younger mathematicians, both at the Courant Institute and worldwide.

Biographical Sketch

Louis Nirenberg was born on February 28, 1925, in Hamilton, Ontario, Canada. He received his B.Sc. from McGill University (1945), and his M.S. (1947) and Ph.D. (1949) from New York University. He began his academic career at New York University, where he advanced from research assistant to research associate (1945–1951) and then from assistant professor to associate professor (1951–1957). Since 1957 he has been a professor at NYU.

A member of the American Mathematical Society for forty-six years, Professor Nirenberg has served as a member-at-large of the Council (1963–1965), as vice-president (1976–1977), and on the following AMS committees: Program Committee (1960), Executive Committee (1965), *Transactions and Memoirs* Editorial Committee (1965–1967), Nominating Committee (1967–1973), Committee on Summer Institutes (1968–1973), Committee to Select the Winner of the Bôcher Prize (1969–1970, 1989), Committee on Steele Prizes (1981–1983), Committee on 1983 AMS-SIAM Summer Institute on Nonlinear Functional Analysis and Its Applications, Colloquium Editorial Committee (1983–1985; chair, 1985), Committee on National Awards and Public Representation (1990–1991).

Professor Nirenberg has given the following addresses: AMS Invited Address (New York, February 1958), Symposium on Differential Geometry (Tucson, February 1960), Symposium on Partial Differential Equations (Berkeley, April 1960), International Congress of Mathematicians (Stockholm, 1962), Symposium on Singular Integrals (Chicago, April 1966), Summer Institute on Global Analysis (Berkeley, July 1968), AMS Colloquium Lectures (San Francisco, January 1974), AMS-MAA Invited Address (Orono, August 1991).

Professor Nirenberg received the Bôcher Prize (1959), was a Sloan Fellow (1958–1960), and was a Guggenheim Fellow (1966–1967 and 1975–1976). In 1982 he received the Crafoord Prize. He has been awarded an Honorary Doctor of Science from McGill University (1986), University of

Pisa (1990), and Université de Paris IX, Paris-Dauphine (1990). He was awarded Honorary Professorship at Nankai University (1987) and Zhejiang University (1988). He is a member of the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences. He is a foreign member of Accademia dei Lincei, Académie des Sciences de France, Accademia Mediterranea Delle Scienze, Istituto Lombardo, Accademia Scienze e Lettere, and Academy of Science of Ukraine. His research interests include partial differential equations, fluid dynamics, differential geometry, and complex analysis.

Response from Louis Nirenberg

I am very honoured and enormously pleased to be awarded the Leroy P. Steele Prize for Lifetime Achievement. As the kind citation says, my work has centered around Partial Differential Equations (PDE), and I've been lucky to be at the right place at the right time. I had the good fortune to come to New York University as a graduate student after the Second World War. Richard Courant and Kurt Friedrichs began to establish a center for work in PDE, which eventually grew into the Courant Institute, one of the world centres in the subject.

There were some extremely talented fellow students: Harold Grad, Peter Lax, Joe Keller, Martin Kruskal, Cathleen Morawetz to name a few. Interaction with them was very important for me, particularly with Peter Lax, from whom, over the years, I have learned many things in mathematics. My thesis adviser was Jim Stoker, who was in turn a student of Heinz Hopf. But the teacher who influenced me the most was probably Friedrichs. His teacher was Courant, who was in turn a student of Hilbert—not a bad lineage. From Friedrichs I believe I acquired a certain point of view: developing general techniques and methods is often of greater interest than proving some particular result. In addition I acquired a love for inequalities.

The period since my graduate school days has been a golden one for PDE. There were masters working in the subject, whose work greatly affected mine: beside those mentioned, Fritz John, a colleague; Jean Leray in Paris; Hans Lewy and C. B. Morrey in Berkeley. In addition, during this golden age, there were (and are) wonderful contemporaries; to name just a few (not already named) whose work greatly influenced my own: Shmuel Agmon, Alberto Calderón, Ennio De Giorgi, Lars Gårding, Lars Hörmander, Jürgen Moser, John Nash, Paul Rabinowitz, S.-T. Yau, and many more, including some below and a number in the former Soviet Union. The citation mentions joint work. In fact, 90 percent of my papers are joint, and this is an opportunity to thank some of my coauthors; I can only name a few. Collaborating with others has been one of the greatest pleasures for me in doing mathematics. Agmon and I wrote several joint papers, some with Avron Douglis, and they played a big role in shaping my future research. The papers I wrote with Lipman Bers (from whom I learned a lot), the one with Morrey, the one with S. S. Chern and H. I. Levine, and especially the one with Fritz John, gave me great pleasure. A paper I wrote with Phil Hartman on geometry, not PDE, was rather elementary but great fun

to do. Though Peter Lax and I have been colleagues all these years, we published only one joint paper, but I continue to learn things from him.

It was a great pleasure to work with François Trèves on local solvability of linear PDEs and then with Joe Kohn on various things. Incidentally, Friedrichs suggested the name “pseudo-differential operators”.

I would like to mention also a joint work with K. Kodaira and Don Spencer in complex analysis—I attended their “Nothing Seminar” in spring 1952—and one with Charles Loewner in geometry. Their names remind me that one of the joys of being a member of the family of mathematicians is that one gets to know so many lovely and interesting people.

For the last twenty-five years or so I have worked mainly on nonlinear problems. In recent years I have had the great good fortune to work with Haim Brezis, Luis Caffarelli, David Kinderlehrer, Bob Kohn, Joel Spruck, Vassilis Gidas, and Wei

Ming Ni, and most recently with Henri Berestycki and S.R.S. Varadhan.

I have also been blessed by having many talented students and have learned much from them as well as from many of the postdocs we have had at Courant Institute. One semester I ran a seminar for postdocs and faculty in which people described problems on which they were stuck—I called it group therapy for analysts—such as a lemma or inequality they needed. Or else, they discussed some known result for which they thought there should be a better proof. It was a big success—a number of the problems posed were even solved—and I recommend to everyone to try it. Of course, you need a minimal list of problems on hand in order to get it started.

This award is for lifetime achievement; I’m still doing or trying to do mathematical research. I’m slower and make more mistakes, but it’s still an enormous pleasure. My warmest thanks to the Steele Prize Committee for this lovely award.

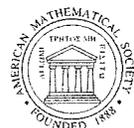
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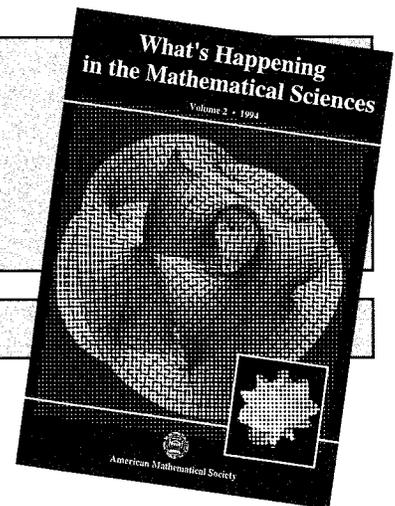
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International Affairs

Events over the Past Year Spur Debate about the Role of the U.S. Mathematical Community in the International Arena

The past year has seen a great deal of debate within the U.S. mathematical community about its international role. What activities should be initiated, who should carry them out, how should various efforts be coordinated—these and other questions have been raised. Much of the discussion has focused on the U.S. National Committee for Mathematics (USNCM) and the International Mathematical Union (IMU) as key players in the international arena.

Last year, in a highly controversial move, the Board on Mathematical Sciences (BMS), the administrative body overseeing the USNCM, shifted the title and activities of the committee to the BMS itself. The Board made it clear at the time that the arrangement was temporary, but no clear plan for the future was presented. The debate over this event, together with intense discussion about future directions for the USNCM, has fueled a wider discussion about the international role of the U.S. mathematical community.

A Byzantine Structure

One of the difficulties in trying to get a handle on international activities is that the structure gets byzantine very quickly. In the U.S., the National Academy of Sciences (NAS) is a key player. The NAS “adheres” to international scientific unions through its system of thirty-four discipline-based U.S. National Committees; one of these is the USNCM, which provides a link to the IMU. Currently the IMU has under its wing National Committees for Mathematics from over fifty countries around the world. The IMU, like other international scientific unions, is a member of the International Council of Scientific Unions, a Paris-based umbrella organization.

International representation for most scientific disciplines in the U.S. goes through the NAS, but there are exceptions. For example, the International Committee on Industrial and Applied Mathematics only accepts as adhering organizations those that have open membership, which clearly leaves the NAS out. In other countries, adherence to international scientific unions often goes through an entity such as the NAS, but there are exceptions here as well: for example, in Germany the organization adhering to the IMU is the German mathematical society, Deutsche Mathematiker Vereinigung.

What do the U.S. National Committees do? Within the NAS some of the major general functions are to nominate delegations to international meetings, to nominate U.S. repre-

sentatives to international unions, to inform domestic groups about international activities, to promote international activities (such as studies or meetings), and generally to strengthen international research linkages. Individual committees may have other responsibilities specific to their disciplines. The U.S. National Committees are funded primarily by the National Science Foundation (NSF) through the relevant disciplinary divisions. Support of around \$20,000 to \$30,000 per year for USNCM comes from the Division of Mathematical Sciences of the NSF. The administration for each U.S. National Committee falls under the relevant disciplinary unit of the NAS, which for the USNCM is the BMS.

The BMS Resolution

One of the precipitating events in the recent debate over international activities came last year, when the BMS made a major change in how it oversees the USNCM. Over the past two to three years, the Board discussed with the USNCM ways to expand the range of the Committee’s activities and to make it more proactive. In May 1993 the BMS, dissatisfied with its negotiations with the USNCM on this question, passed a resolution to temporarily transfer the title and activities of the USNCM to the BMS itself, in effect dismissing those who were members of the USNCM at the time. The resolution said that the BMS would reconsider the structure of the USNCM no later than spring 1995.

Shmuel Winograd of IBM at Yorktown Heights was chair of BMS at the time the resolution was passed. “Essentially the way USNCM was operating, it saw its charter solely as arranging for a U.S. delegation to the ICM and the IMU meeting once every four years,” he says. “The Board, as well as the Commission on Physical Sciences, Mathematics, and Applications [the larger NAS body overseeing the BMS], was looking for a committee that would be more active and [would] widen its scope of activities.” Also on the Board at the time was Ronald G. Douglas of the State University of New York at Stony Brook. Events of recent years—such as the fall of the Soviet Union, changes in Eastern Europe, and shifting trading patterns—have a potential impact on the mathematical sciences, says Douglas, but the BMS felt somewhat powerless to respond. The Board wanted to broaden its international agenda, but, says Douglas, its perception was that the USNCM was not willing to take the necessary proactive stance.

Linda Keen of the City University of New York was chair of the USNCM at the time. She says that pressure to make the USNCM more proactive predated her tenure as chair. "When I took on the chairmanship, I was concerned about this [pressure]. I told a number of people that I did not see [the USNCM] as a proactive committee but as a liaison, a gadfly for issues, not as the place to initiate lots of international activities." Keen maintains that in many cases the professional societies are better equipped to take on the kinds of international activities the BMS was considering. During her tenure as chair, she points out, the USNCM did in fact do more than plan for the U.S. delegation to the ICM: for example, it responded to requests for information and advice about various international affairs, such as support for the Nevanlinna Prize (given at the same time as the Fields Medals), and discussed a possible exchange program with the African Mathematical Union. She says the USNCM was caught in a crossfire of complicated tensions between the BMS and other organizations over who should be doing what in the international arena.

Funding was another difficult point. All of the NAS boards rely entirely on outside funding for the projects they carry out. The boards' purpose is to provide advice on public policy issues in which science has an impact. In such areas as physics or chemistry, there are many such issues, while in mathematics there are fewer, or at least the issues are less obvious. For this reason, the funding situation for the BMS has been less stable than for other NAS boards. The matchup between available funding and reasonable activities has always been a problem for the Board, and this problem extended to the USNCM as well. Had the BMS and the USNCM been able to agree on what the Committee should be doing, then funding would likely have been no problem. But their disagreement began to threaten funding for the USNCM, further polarizing communications between the Board and the Committee. Adding to the problems was the fact that funding is tight for scientific projects of any kind; should funds go to new international activities when high-level American mathematicians are losing their grants? Some argue that the two kinds of funding are essentially separate, but fears of the "zero-sum game" are rampant in the current fiscal climate.

To some who had been in on the negotiations, the BMS resolution to take over the USNCM was not a sudden step, given the fact that the two had for so long been unable to come to an agreement. But to those at some distance from the process, the BMS resolution was surprising—and infuriating. The AMS Council passed a resolution charging the AMS president "to transmit to the BMS its great dismay at the dissolution of the previously broadly representative USNCM and its demand that the former USNCM be reinstated immediately." The Conference Board of the Mathematical Sciences (CBMS), which traditionally chose five of the nine USNCM members (the BMS chose the remaining four), passed a resolution saying that it "views with great concern the changes proposed by the [BMS] for the structure and activities of the USNCM." Although Douglas believes that some action was needed to break the impasse between the

BMS and the USNCM, "in retrospect it would have been wiser for the Board to involve a bigger group, especially the CBMS" in the decision.

Next Steps

In the wake of the controversy over the BMS action, the idea of having the AMS administer the USNCM was raised. In fact, the AMS Council resolution denouncing the Board's action directed the AMS Executive Committee to look into the possibility of the AMS or a consortium of professional organizations becoming the body that adheres to the IMU. It soon became clear, however, that changing the adhering organization would be difficult, and discussion shifted to focus on the AMS providing an administrative base for the Committee. The Society's Long Range Planning Committee has discussed this plan, and it is sure to resurface at its meeting this fall.

The idea of the AMS administering the USNCM has been broached with the NAS, at least in a preliminary way. About six months after the BMS resolution, the AMS received a letter from James Wyngaarden, foreign secretary of the NAS, asking for input for an Academy review of the U.S. National Committees and their relations to the International Council of Scientific Unions. The response, signed by AMS Secretary Robert Fossum and AMS President Ronald Graham, contained a proposal that the NAS assign to the AMS the duty of organizing and coordinating the activities of the USNCM and the relations between the U.S. mathematical community and the IMU. This would follow the model of the Canadian National Committee, which is now under the Canadian Mathematical Society, in partnership with the National Academy of Sciences of Canada. The letter also stated that other mathematical organizations having an interest in the USNCM would be consulted in the development of a more detailed proposal.

The matter of bringing in other organizations is crucial. Ramesh Gangolli of the University of Washington, who now chairs the CBMS, notes that some have been surprised that discussions about shifting the locus of representation from the NAS to the AMS have not gone further. The surprise likely results from "an insufficient appreciation of the organizational difficulties and, frankly, the political difficulties of shifting that locus," he says. Other organizations have to be convinced that their representation "would not be treated in a second-hand fashion." Although he is certain that the AMS leadership would insure the proper representation, Gangolli says his impression is that the applied and statistical communities might not be happy with the AMS running with the ball.

Gangolli points out that if the USNCM is to be a reactive committee—with its activities restricted to acting as a liaison for the IMU and assembling a delegation for the ICM—then it does not much matter where it resides. However, if there is consensus that the USNCM should take on a more proactive role—organizing programs to help mathematicians in developing countries, initiating international conferences, and the like—then the Academy may not be the best home. After all, the NAS is by charter an advisory group. "The

National Academy is not an action organization, so the result is that the USNCM has been a fairly passive body," Gangolli explains. "By their nature, the professional societies are better equipped to take on action items than is the National Academy."

However, some say it would be difficult for the AMS to provide an international profile comparable to that of the NAS. With its system of U.S. National Committees ranging over all areas of science, its Office of International Affairs, and a foreign secretary, the NAS clearly has the necessary infrastructure. In addition, the Academy is the focal point for formal international affairs of the U.S. scientific community. Some believe that there are not sufficiently compelling reasons for the mathematical community to set itself apart from the other sciences and form a USNCM outside of the Academy.

Others disagree, saying that the prestige of the NAS has done little to benefit U.S. mathematics. Fossum argues that moving the USNCM to the AMS would save money, increase accountability, and greatly improve communication. Says Fossum, "I want to see the mathematical community of the U.S. determining the policy of the USNCM, not a self-perpetuating group of 135 individuals."

Dissatisfaction with the IMU

The Fossum-Graham letter also expressed strong dissatisfaction with the lack of openness in the activities of the IMU. As an example, the letter stated, "While members of the U.S. mathematical community eagerly await, each four years, the announcement of plenary and other speakers at the ICM and while those members who are selected enjoy an enhanced reputation, the selection process remains a mystery to all but the handful of mathematicians who have served on the selection [panels]." The names of those on the committee choosing the Fields Medalists, as well as those on the ICM Program Committee, are announced only after the Congress has begun. However, the names of those on the panels selecting invited speakers are never revealed. In addition, the IMU has not collaborated with other mathematical organizations in assembling lists of recommended speakers.

Opinions differ on whether the secrecy is necessary, but everyone agrees on one thing: the stakes are incredibly high. Being invited to give a talk at the ICM "can make a huge difference in one's professional status," says Fossum. "It can mean a \$10,000 salary increase." Because the panels must consult with other experts, their identities cannot be kept entirely secret. Fossum says he has heard stories of people wining and dining panelists in the hope of wrangling an invitation to speak. A letter to the editor of *Notices* (March 1994, page 180) from V. I. Arnold gives an indication of the kind of quid pro quo proposals that are made in connection with such major international events as the ICM.

Joan S. Birman of Columbia University, who currently chairs the AMS Long Range Planning Committee and was on the USNCM when Keen was chair, served on a panel to select invited speakers for ICM-90 in Kyoto. Each panel presents a list of recommended speakers to the ICM Program Committee, which makes the final decision. Birman says

there was outside pressure on the panels and on the Program Committee, not only from individuals hoping to see their mathematical specialties represented, but also from those who wanted to see speakers from particular countries invited. "Some people believe that it is so political, that there is so much pressure on the panels, that they couldn't make a decision if it were not secret," she says. "I found just the opposite": suggestions taken openly from the public would have been preferable.

Birman calls the entire process "extremely undemocratic" and says that the mathematical community ought to have a bigger role in how the ICM is organized. She believes that "the USNCM could be a powerful force for democratizing the ICM and making it more open"—but not if it remains at the National Academy. The Fossum-Graham letter expresses similar views. After discussing various problems with the IMU, the letter stated, "We could go on with many other instances in which the members of the mathematical community and the leaders of the various mathematical professional societies have been ignored because of the method by which this community is represented at the IMU level." The letter went on to suggest that moving the USNCM to the AMS would help alleviate these problems.

David Mumford of Harvard University was elected president of the IMU at the meeting of the IMU General Assembly just before ICM-94 in Zürich. "Traditionally, the reason for the secrecy of the panels was to prevent any outside pressure, so that the speakers are chosen purely on the basis of merit," Mumford explains. In the past, political pressures, especially from the Soviet Union, made secrecy necessary, but this is no longer such an important issue. "I've been astonished to find a huge range of opinion" on the question of the secrecy of the panels, says Mumford. "Some think it's absolutely essential to have secrecy, and others think it's really a bad thing." Although Mumford believes that the panels have worked well by and large and that changes should not be made overnight, he also says more discussion of the pros and cons is needed.

Already there are some indications that, slowly, things may be changing. At its meeting in Switzerland, the IMU General Assembly decided that the name of the chair of the ICM Program Committee should be made public upon appointment, not just after the ICM has begun. In addition, the General Assembly broke with IMU tradition and sanctioned collaborations between the IMU and applied mathematics organizations in planning the applied mathematics portion of the program for ICM-98 in Berlin.

The CBMS Workshop

In May 1994 the CBMS convened a workshop to look at the issues that had been circulating for the previous year: what the USNCM could do and what organizational structure would be most effective. The workshop brought together representatives of the CBMS member organizations, the National Research Council, and the NSF. In addition to twenty-five invited participants, about another dozen individuals were asked to serve as consultants to the workshop and provide information, views, and ideas. (CBMS decided that the workshop should

also include consideration of the U.S. National Committee on Mathematical Instruction (USNCMI). There had been no indication of any problems with the USNCMI, but the CBMS thought it best to consider the two national committees in parallel.)

The main product of the workshop is a report outlining three major areas of activity which, in order of importance, are: communication and coordination (including liaison with the IMU); advocacy (including issues such as gender and ethnic equity, human rights, and free circulation of scientists); and initiation of activities through other U.S. professional organizations (here the National Committees would be "nonactivist", identifying opportunities for international cooperative activities, such as conferences and exchanges, and encouraging the relevant professional organizations to carry them out).

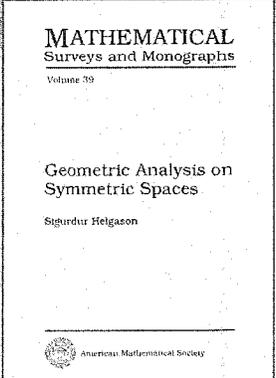
Jill Mesirov of Thinking Machines Corporation, who was CBMS chair at the time of the workshop, notes that the report is much more explicit about the kinds of activities the USNCM should pursue than is its existing charge. An important aspect of the report, she notes, is that it allows sufficient flexibility for the USNCM to change its emphases over time as the membership on the Committee changes, while also establishing a "baseline level" of activity that the Committee should meet.

The report says that although a majority of those present at the workshop felt that there were advantages to the USNCM remaining at the NAS, a significant minority of about 30% favored another home for the Committee. However, the report notes, "It was difficult to discuss alternative homes for the

national committees because there were no specific proposals brought to the meeting." The workshop participants therefore concluded that it would be acceptable for the USNCM to remain at the Academy as long as there is "a clearly stated understanding of the expectations for the Committee." The report emphasizes that this decision was made "without prejudice with respect to the notion of seeking an alternative adhering organization for the committees". In this way, the report leaves the door open for the possibility of the USNCM leaving the Academy. But for now, the USNCM remains at the NAS, and the possibility of a move to the AMS continues to be discussed.

Although some were disappointed that the CBMS workshop did not result in a plan for a new administrative home for the USNCM, many were glad that the issues had been aired. "It was probably the only time ever that this set of issues was discussed in almost any forum, let alone an open one," Douglas remarks. "Most people there were concentrating on the future—trying not to simply argue about the past, but trying to identify what the role for the USNCM should or could be." Avner Friedman of the Institute for Mathematics and its Applications, who started a term as chair of the BMS in July, notes that the CBMS workshop provided a good opportunity for the various mathematical organizations to share ideas about international affairs. Out of all the controversy has come something positive, Friedman notes: "Now people know there is a U.S. National Committee!"

Allyn Jackson



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Preparing for a Job Outside Academia

Stan Benkoski, Wagner Associates

Stan Benkoski is chair of the AMS-MAA-SIAM Joint Committee on Employment Opportunities and a member of the Subcommittee on Employment of the AMS Committee on the Profession.

The current difficult job market for Ph.D. mathematicians has been well documented by many sources. In July 1992 the AMS Task Force on Employment estimated that “the U.S. job market will demand around 800 new mathematical sciences doctorates per year over the next ten to fifteen years.” The 1992 Annual Survey of new doctorates (*Notices*, November 1993) shows that U.S. institutions awarded 1,202 doctorates in the mathematical sciences between July 1, 1992, and June 30, 1993. This represents a tremendous imbalance in supply and demand. This imbalance is probably understated, since those statistics do not take into account the cumulative effect of the oversupply of doctorates in the years leading up to 1992–1993 and also do not account for the number of emigrant mathematicians who have come to the U.S. in recent years.

One of the recommendations of the AMS Task Force on Employment was that “the AMS use the various means available to it to make clear to the mathematical community the value of, and opportunities for, nonacademic employment.” The purpose of this article is to attempt to respond, in part, to this challenge. In particular, these remarks will be directed at second-year graduate students. (The information should also be helpful to any graduate or undergraduate student or to a faculty member who wants to learn more about mathematics in industry.) The goal is to provide information about the nonacademic job market and describe steps to prepare to obtain a job in that market.

For the purposes of this discussion, I will use the word “industry” to refer to the possible fields of employment that are outside of academia.

A couple of caveats are appropriate. First, most second-year graduate students have spent most of the last nineteen years in school. The academic environment is well known, understood, and comfortable. The effort to learn about nonacademic mathematics usually starts from a position of very little knowledge. Second, students will be required to do a lot of the work themselves. In particular, there is currently no single

source which will provide comprehensive information about industrial mathematics.

The remarks that follow fall into three sections. First, I briefly describe my background in order to establish my credentials and biases. Second, and perhaps most important, is a somewhat philosophical discussion about the differences between employment within academia and outside academia. I believe that seeking a position (and being successful) in industry requires a different mindset than in academia. If this different mindset is not achieved, then the specific suggestions in the third section are unlikely to be successfully employed.

Background

I have worked for Wagner Associates for twenty-one years. We are a consulting firm in mathematics, operations research, and software development. In the thirty-one-year history of the firm, we have worked on a wide variety of problems. The vast majority of our work has been funded by government agencies. In particular, the Department of Defense (in various guises) has been our biggest sponsor. A lot of our work has been in the search for lost objects, such as satellites or sunken ships.

I received my Ph.D. in number theory from The Pennsylvania State University in 1973. My academic training was in pure mathematics: I did old-fashioned elementary number theory. (My Erdős number is 1.) The experience of looking for a job in 1973 gives me some empathy with current job seekers.

While my academic training was in pure mathematics, I had three summer jobs which used applied mathematics. Two of these were government jobs. The technical work in these jobs involved operations research and software.

I first made contact with Wagner Associates at the Employment Register at the Joint Mathematics Meetings in 1973. Wagner Associates was (and still is) unusual in that when hiring, it sought research quality in mathematics and not necessarily an education in applied mathematics. However, I am sure that my work experiences allowed me to stand out from the crowd.

I personally found the transition to industry to be a relatively easy one. (Some of that ease of transition must be attributed to my previous experience with summer jobs.) I have thoroughly enjoyed the breadth and depth of work that

I have done. However, it is quite different from an academic experience. Each individual has different priorities and goals, which may or may not fit into an industrial setting.

Philosophy

The change in philosophy that is required for an effective industrial job search can be summed up in two sentences. In academia, you get hired if they believe that you are smart. In industry, you get hired if they believe that you can help them.

The graduate student must assume 100% of the responsibility for finding out what opportunities are available and for convincing an industrial employer that he or she could make a contribution.

At one level, mathematics is like the arts (philosophy, drama, music, etc.). It is intrinsically valuable, and our society supports that endeavor. The arts enrich our lives and are part of the “examined” life. However, on another level, mathematics is quite different from the arts. In particular, our society spends a much greater proportion of its capital in support of mathematics than the arts. We like to think mathematics is somehow a high-level endeavor that is intrinsically superior to other studies. The crass truth is that mathematics receives greater financial support primarily because it is an “enabling technology”. Its application and practical use are what gives it a privileged position.

The perspective of business is quite different from that of academic mathematics departments. Few businesses believe that they can afford basic mathematical research, and they probably cannot justify it to their stockholders. As an institution, the interest a business has in a mathematician is based on the need to solve problems requiring mathematics. The company’s desire is to do something better, faster, smaller, cheaper, etc. Mathematics is a means, not an end. Industrial mathematics problems rarely appear as such. The value a mathematician brings to industry is the ability to see a problem which is posed as a real, practical problem (or perhaps see something that is not even perceived as a problem), state that problem in mathematical terms, and proceed to develop insight into the problem which results in quantifiable improvements.

As a mathematician who has worked in industry for many years, it is amusing and somewhat annoying to observe the negative correlation between the job prospects for mathematicians and the academic mathematics community’s interest in greater involvement in industry. If the academic mathematics community really believed that doing mathematics in industry is a noble profession, then the community would be interacting with industry and sending a share of the best students into industry in good times as well as bad. But the interest ebbs and flows with the job market, and, when hard times hit, industrial opportunities get more attention.

Specific Suggestions

In this section, I give some specific suggestions for ways to learn more about industrial employment. These are:

- College career centers

- Reading/seminars/short courses, etc.
- Academic classes in a broad range of subjects _____
- Experience

Many college career centers are excellent places to learn about industrial employment. Most of the information provided there concerns industrial employers. A great deal of literature is available that describes what these employers do and the skills and talents they require. In addition, some of these employers may be looking for part-time, internship, or summer help. Visit this center and find out what they have to offer.

One of the goals of this process is to learn about applications of mathematics by reading, attending seminars, attending short courses, etc. SIAM puts out a number of publications that would be useful. (For example, the March 1994 issue of *SIAM News* contains an article on the use of linear programming to maximize delinquent account strategies in the consumer credit business.) In addition, the SIAM Mathematics and Industry Project is directed at improving the match between graduate education and industry. The *Journal of Operations Research* would be a good place to start to learn about operations research. Other good topics are biotechnology and digital signal processing.

Taking academic classes in fields other than mathematics in order to expand one’s knowledge of application of mathematics is another useful idea. The most directly applicable courses will be in computer science. Computer science comes first and foremost, because almost any summer or part-time job will involve writing software. Most full-time jobs require (as a minimum) a working knowledge of software and may well require the ability to write good code. Other suggestions would be numerical analysis, biology, economics, engineering, physics, statistics, and operations research.

The most important suggestion is to actually work in an industrial environment. Doing so provides experience in what goes on in an industrial job as well as an opportunity to determine one’s aptitude for, and interest in, industrial employment. (Of course, any one particular experience is a very small and biased sample of industrial employment. Another job at the same company or a different company could be a totally different experience.) In addition, the best reference when applying for a job is solid evidence that one has already accomplished something similar.

How does one get such experience? One of the best bets is summer employment (part-time work is also useful). There are two basic sources of summer jobs—government and business. The government is probably the best source, since there are fewer institutions to contact and there are often specific programs to support summer employment. The government also has employment offices which have lists of available positions and directions on how to apply. Large companies have personnel offices which can provide the same kind of information. These methods can be successful, but they require work. There are also online services such as Help Wanted—USA (telephone 813-725-9600 for information), E-span employment database (telephone 800-682-2901 for information).

An even better method is to get a contact inside the company. One approach to this is called networking. Talk to your friends, acquaintances, professors, etc. Let it be known that you are looking for summer employment. The campus career center may also be able to help.

One very effective process is known as consult visits or informational interviews. A consult visit consists of a twenty-minute interview with someone in industry who is involved in applying mathematics. The steps in the process are:

1. Develop a list of names and addresses of individuals involved in mathematics in industry
2. Research the company and the person you will visit
3. Write letters to some of those individuals
4. Make follow-up phone calls
5. Interview
6. Follow-up

The first step in this process is to find individuals who may be appropriate for consult interviews. The *Combined Membership List* is a good source of names and addresses of mathematicians who live in your vicinity and work outside academia. For example, I was recently asked to speak at the University of North Texas on the job opportunities in industrial mathematics. I found that the *Combined Membership List* contains eleven companies in the greater Dallas area that have employees who belong to AMS, MAA, and/or SIAM. There was a total of 107 listed members who are not associated with a college or university. This appears to be a rich source of possible contacts for consult interviews.

Prior to the consult interview, a substantial amount of preparation is required. In particular, one must know what sort of business the company is in and as much as possible about the individual who will be interviewed. Sometimes this can be accomplished by simply calling the company and asking for appropriate information. Other sources include the library, online newspapers, *Hoover Handbook Company Profiles*, trade magazines, etc. At the minimum, you should know what the company's main lines of business are.

Following is an example of a consult letter. This should be tailored as much as possible by mentioning the company name, the kind of work it does, and so on.

In the follow-up phone call, simply mention that you are following up on your letter and would like to know if it would be possible to schedule a twenty-minute appointment to discuss the application of mathematics in that particular company.

The interview itself should be conducted as an interview of an expert. The objective is to determine how mathematics is being used (or could be used) at that company. If, during the interview, the discussion moves toward possible part-time, internship, or summer work, then this is a golden opportunity.

At the end of the interview, ask the individual if he or she can recommend anyone else who could provide information

on mathematics in industry. Follow-up on those leads. Send a thank you letter within three days of the consult interview.

Some diligent work with consult interviews should produce a much better idea of what is done in industrial mathematics plus some possible leads for summer or part-time jobs.

YOUR NAME
YOUR ADDRESS
YOUR PHONE NUMBER

Date

Name
Title
Company Address
City, State, Zip

Dear :

I am a (graduate student, undergraduate, ...) at (name of school) in mathematics, and I am interested in learning more about the opportunities for mathematicians outside of academics. I obtained your name from the *Combined Membership List* which indicates that you are a member of (SIAM, AMS, MAA, as appropriate). I would like to ask for twenty minutes of your time to hear your views on the opportunities for mathematicians at an organization like (company name). In particular, I would like to discuss the kind of mathematical problems that your company faces. I would be glad to meet at your office at a mutually agreeable time.

I will call in the next week to determine if we can arrange a time to meet.

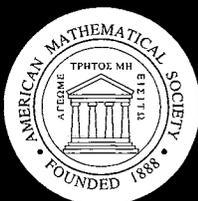
Sincerely,

(original signature)
Your Name

Summary

Effectively investigating industrial mathematics is not an easy task. It does not require advanced skills, but these skills simply are not taught in academia. It does require a serious commitment of time.

The result of such an effort might be the realization that only an academic career is of interest. On the other hand, such an effort might generate a set of rich and challenging opportunities in industrial mathematics.



Centennial Fellowships

Invitation for Applications, 1995–1996

Deadline December 1, 1994

These fellowships are intended to provide enhanced research opportunities to mathematicians who are several years past the Ph.D., who have a strong research record, but who have not had extensive postdoctoral research support in the past. Applicants should have received the Ph.D. degree between January 1, 1983, and December 31, 1988, and should not have had the equivalent of more than two years of full-time postdoctoral support.

The stipend for fellowships awarded for 1995–1996 has been set by the Trustees of the Society at \$43,900 for nine months. In addition, there will be an expense allowance of \$1,435. Applicants must be citizens or permanent residents of a country in North America. The fellowship may be combined with other stipends and/or part-time teaching; this option can be used to extend the award to cover a period of up to two years. For further information about the acceptability of such arrangements, individuals should contact the secretary of the Society.

The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Trustees have arranged a matching program from general funds in such a fashion that funds for at least one fellowship are guaranteed. Because of the generosity of the AMS membership it has been possible to award two or three fellowships a year for the past several years.

The deadline for receipt of applications is **December 1, 1994**. Awards will be announced in February 1994, or earlier if possible. For application forms, write to the Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940 or send electronic mail to ams@math.ams.org.

Education Reform From a National Perspective: The Mathematics Community's Investment and Future

Hy Bass, Columbia University

Hy Bass is chair of the Mathematical Sciences Education Board of the National Research Council. This article is based on his keynote address at the Third Conference on the Teaching of Calculus, held at the University of Michigan, June 24–25, 1994.

The Cold World Order

This is a difficult time to be growing up. Gone are the leisurely and philosophically curious students of my era. Today's college student tends to measure every course by its contribution to still precarious job marketability and to several years of post-graduation debt service and to view each social relationship as a potential deadly health threat. These students are not cynical, just learning to cope with the world that our culture has created for them—the “New World Order”.

The Old World Order—we might better call it the “Cold World Order”—was dominated by the cold war and its threat of nuclear devastation. But for those of us who escaped the conflagrations in Korea and Vietnam, this threat was remote and therefore entered our lives only psychologically and morally. At the same time, since security—along with health and the lottery—is one of the few things for which Americans willingly pay taxes, many social programs, including education, benefitted generously from perceived security needs. These called for a strong research base and for a large cadre of skilled scientific professionals. Our institutions of higher education delivered brilliantly on these needs and became the envy of the world.

Today we tend to see education as built on three foundations: content, pedagogy, and assessment. In this optic, I would say that education in the Cold World Order focused almost entirely on strengthening content. Pedagogy was entrusted to its historic lecturing model and given little nurturing and almost no innovative attention. Assessment was narrow and brutal, filtering many students out of scientific courses. But this was politically benign, since, helped by the influx of foreigners, we could easily supply the national scientific needs

with the surviving students, mostly white male or oriental emigres.

This was the context in which the “New Math” reform was born. Mathematicians, enthusiastic with the spectacular advances in basic research, noted that school mathematics remained immune to these developments, being still rooted in mathematics of the nineteenth century and before. They joined therefore with eager school teachers to enrich school mathematics with some of the profound new contemporary ideas and discoveries. Since this was a period of triumph for axiomatic methods—for example, in topology and in algebraic geometry—mathematicians tried to reflect this in school curricula. Whence the prominent appearance of set theory in the early grades and of axiomatic algebra somewhat later. For all of its faults, this much-maligned reform effort had many excellent features, achieving significantly improved performance in high school mathematics; many of today's prominent mathematics education professionals were incubated in those programs, which were soon to be brutally aborted. The failure of New Math was one of implementation in terms of teacher training, primarily in the elementary grades, where teachers had no mathematical resources of their own on which to draw nor were they provided with sufficient opportunity for professional development. It was naive about pedagogy, confusing the mathematically logical point of departure (in content) with the psychological point of departure (in students).

But, except for a bad public aftertaste, the failure of New Math was not a disaster, because no high national imperative was at stake. The movement was primarily intellectually inspired.

With the winding down of the cold war, education, like other social programs, was disarmed of its national security rationale and foundered. We have witnessed a profound deterioration in our schools and indeed in the whole social fabric in which many young children grow up in America, socially alienated and deplorably educated.

The nation began to seriously address this vast problem only a few years ago with the publication of documents like *A Nation at Risk*. While the moral and social concerns were always present, it is my view that the real turning point came when the business community joined the crusade; finally,

education acquired an advocate with the kind of political clout to move reluctant taxpayers. Businesses recognized the cost of training educationally dysfunctional new employees. And they understood that, to remain competitive in the new global economy, our most important asset will be a highly skilled and quickly adaptable work force.

Such a challenge faced this country during the period of industrialization early in this century, at which time America introduced one of the world's first universal education systems. Its aims were to convey a broadly supported code of social responsibility and conduct and to provide the basic literacy skills needed for a mass production economy in which work performance was limited and stable. University education, which cultivated higher-order skills for critical thinking, problem solving, making informed judgements, speculating, communicating with style and clarity, and so on, was reserved for a select population qualified by privilege or special talent.

The contrast of the present with this past reform is that the quality of education formerly sought only for the privileged class entering higher education must now be achieved for essentially all students. This universalist aim of the present reform movement—a technically sophisticated level of education for *all* students, at all levels—is unprecedented and, I dare say, revolutionary. It is hard to imagine soon achieving this in America, and many claim that it is impossible. But countries like Japan and Germany show that the problem is not in our genes. Large-scale low performance of students must now be judged to be the failure, not of the students, but of the educational system.

Systemic Change

There is a strategic dilemma in addressing this challenge. Whereas the problem is systemic and national in scope, the system to be reformed is heterogeneous and locally controlled. In fact this local control is partly a myth. Two national level forces, the textbook publishing and educational testing industries, exercise a major and homogenizing influence on American education. But these forces are driven more by market performance than by educational policy. In fact this makes them sometimes vulnerable to manipulation by parochial state textbook adoption committees. An example familiar to you in the Calculus Reform Movement is the issue of reconciling the AP calculus programs and tests with your efforts.

In developed countries with which we choose to compare ourselves, one would turn, for education reform, to the ministry of education. But we, in contrast, have no locus of national authority for educational policy. Our Department of Education has, until recently, been mainly a caretaker for entitlement programs. The Education and Human Resources Directorate of the National Science Foundation (NSF) controls the major discretionary resources for innovative reform, and it has funded numerous individual projects. Yet the urgency of the problem does not allow it to be addressed by isolated and uncoordinated local efforts. So where can we invest the authority—moral and political, if not legal—to lead and orchestrate national reform? The only finally acceptable

American answer, to my mind, is that it resides in the aggregate of communities that are significantly vested in the educational process: students, teachers, parents, school administrators, academic educators, scientists and mathematicians, publishers, educational testers, business leaders, government agencies, politicians, . . . This does not answer the question, but rather transforms it into one of structure and strategy. How does one organize and mobilize these diverse constituencies to act in concert in support of well-conceived educational reform?

Instruments like the Mathematical Sciences Education Board (MSEB) were invented with precisely this kind of objective in mind—a purpose which, in particular, dictates the diversity of its membership. You may find there, besides teachers, mathematicians, mathematics educators, and school administrators, the presidents of the National Council of Teachers of Mathematics (NCTM), the PTA, the Educational Testing Service, a science museum, plus corporate publishing executives, school board presidents, and local political leaders. Its refuge in the National Research Council (NRC) at the National Academy of Sciences gives it access to scholarly expertise and a national level, knowledge-based authority placed outside the federal bureaucracy. A fundamental operating principle of the MSEB is that it moves forward on the basis of broadly cultivated consensus. Further, it accords a prominent place to the teachers as professionals, and so it is no accident that the NCTM is a major partner in much that MSEB does, and conversely.

In what follows, I shall first focus on K–12 education reform in mathematics, then on post-secondary mathematics education reform, then on science education reform, and finally on the current challenges and opportunities for the mathematics and mathematics education communities.

National Standards

It is fair to say that the MSEB, in partnership with the NCTM and supported at the National Academy of Sciences by the NSF, pioneered the currently prevailing strategy for national education reform. The first task was to define the vision, to articulate in tangible form our educational aims and methods. This was the purpose of *Everybody Counts* from the MSEB and of the NCTM *Standards*—for curriculum, for pedagogy, and for assessment. The very idea of “national standards” for education in America is unprecedented, given our tradition of local control. When they were first promulgated, there was fear of a firestorm of backlash to national standards as a violation of local autonomy. It is already a remarkable event that this did not happen. It is a little noted revolution in the politics of education that, at least in policy circles, these standards have been embraced. Indeed the concept of national standards, dressed in the same rhetoric originally invoked by the mathematics community, has now been extended to the sciences, the humanities, and even the performing arts.

The standards are national, not federal. They are a framework, not a prescriptive curriculum. They provide knowledge and skill benchmarks which curricula and instruction are intended to achieve at successive grade levels. They are vol-

untary, not coercive, and the specific form of implementation is under local control.

The NCTM *Standards* have had some, often intemperate, public detractors, for example, John Saxon. But also several thoughtful and educationally concerned mathematicians have found serious fault with various interpretations and implementations of the NCTM *Standards*. They question things like the omission of certain venerable content items, an overzealous emphasis on calculators and corresponding abandonment of the algorithmic skills, the neglect of attention to formal mathematical reasoning (i.e., proofs), the pressure for keeping all students together without special classes for the mathematically gifted (tracking), and generally whether the *Standards*, in their present form, can possibly achieve their stated goals. It is important to note that these concerns can be addressed within the *Standards* framework and that most of the above commentary is really about particular curricula or particular teachers. These critiques are an essential quality control input that mathematicians can offer to the ongoing process of revising and refining the *Standards*. But they are sometimes, regrettably, communicated as an assault on the whole standards movement and in ways that can be perceived as being hostile to the education community.

The Professionalization of Teaching

This is essentially where we now stand in mathematics. We have a good preliminary understanding of what we want to achieve and now have to confront the awesome task of implementation. It is acknowledged by everyone who has thought seriously about these issues that the fundamental and central task is what I like to call the “professionalization of teaching”. Among the many teachers I have met both at MSEB and in the field, there is a remarkable (to me) consistency of view about the sorry state of the schools and about what kinds of things would be most needed for fundamental change. These include obvious things like limits on class size and adequate physical facilities. But most emphatically, they need time to talk to each other, instead of being isolated in classrooms facing students almost nonstop for the full work day. And they need time and resources to attend workshops, professional meetings, etc. They need professional empowerment; this does not mean control over school budgets, etc., but rather over class scheduling and curricular organization, over adoption of resource materials, over matters that directly affect the educational functions for which they are to be held accountable. In short, they need to be able to function as professionals.

To be sure, many math teachers are deficient in disciplinary training, and some are even intimidated by the subject they pretend to teach. This is a vast problem that needs to be addressed both at the level of the schools of education and through in-service programs for the present corps of teachers. But the kind of disciplinary and pedagogical development we might propose to offer will have little effect unless the working conditions of teachers are professionalized. Bringing this about will involve substantial changes in the culture of the schools and in the public commitment of resources.

To help the teachers and school systems make this transformation, new supportive infrastructure has to be put in place. Many community and professional organizations must be mobilized in this effort. MSEB’s outreach activities in helping build the State Coalitions for math and science education reform, with the “Math Connection” organizations, with the Alliance to Involve Minorities in Mathematics, and, most recently, with the mathematics professional societies, have been part of MSEB’s mediating role in this process, which will surely stretch over at least a decade.

Higher Education

The Calculus Reform Movement, to which this meeting is dedicated, has been quietly progressing for the past several years, parallel to but somewhat independent of the K–12 reform activities. Through a variety of experimental collaborative projects, we have reached the point where several serviceable curricula have reached a mature state and experienced mathematicians are now available to assist in their wider adoption, which is now in progress. This is not only a fruitful response to an important educational problem, but it is also a process that has helped to reengage university mathematicians professionally in educational issues. It is one of several educational efforts of which the mathematics community can be justly proud.

Meanwhile, attention has turned to broader concerns with undergraduate education in universities, colleges, and two-year colleges. Stimulated in part by the standards reform movement, the Mathematical Association of America (MAA) has recently produced its “Guidelines” for undergraduate mathematics, and the American Mathematical Association of Two-Year Colleges (AMATYC) has released similar “Guidelines” for two-year colleges. AMATYC is also completing work on curricular standards for mathematics in the first two years of college.

This increased focus on undergraduate educational issues is an overdue redressing of the balance of our professional concerns for basic research, for applications of mathematics, and for teaching and professional service. This is what is publicly urged in the new “National Policy Statement” from the AMS. It is no doubt in part stimulated by the job market crises for mathematics Ph.D.s, who will now require much richer professional versatility.

In fact, we are also in urgent need of a substantial redesign of our Ph.D. programs to enrich the disciplinary skills that we provide so well with broader professional skills in computing, in probability and statistics, and, above all, in communication and teaching. Some have even argued that, just as education in the humanities or in law once provided a cultural platform for a wide range of professional options, today a suitably enriched mathematics or science education could serve the same cultural purpose for a broad range of students.

To restore the professional involvement of mathematicians in educational issues, our professional culture must recognize, assess, and appropriately reward such performance. While this principle is easy to embrace, its implementation presents some subtle issues of defining value and of finding noncapricious

methods of evaluation that command the same confidence that we claim to feel in our traditional evaluation of scholarly work. This important question is addressed in the just-released report of the Joint Policy Board for Mathematics (JPBM), *Recognition and Rewards in the Mathematical Sciences*, and in a related discussion document, *Teaching Growth and Effectiveness*, from MSEB.

Mathematicians in Education Reform

Beyond the needs of undergraduate and graduate education, higher education has a vital role to play in K–12 education as well. First, the school–college transition, through admissions and counseling practices, should not present an inhibition to standards-based reform in the schools. Further, mathematics teaching in college furnishes a primary pedagogical model for most school teachers. So there is an urgent need to attend to the demands of teacher preparation in all of our college and university teaching. This is an issue addressed in the just published resource document *You're the Professor. What Next?* from the MAA. In addition, many academic mathematicians are becoming directly involved in K–12 reform efforts, through critiquing and helping develop curricular and assessment materials, thereby providing a disciplinary expertise and quality control that cannot be furnished by the education community alone. Finally, some are directly participating in professional development workshops for teachers or serving as teacher mentors. The organization MER (Mathematicians and Education Reform) has been instrumental in fostering these kinds of activities.

The mathematics research institutes have also joined in these efforts. The Geometry Center in Minnesota runs teacher workshops and has a program for developing geometric visualization software for use in the schools. The Mathematical Sciences Research Institute in Berkeley has conducted a series of public dialogues of mathematicians with teachers from the Bay Area on educational issues. The Institute for Advanced Study in Princeton now sponsors a “vertically integrated” Geometry Institute involving school teachers alongside mathematicians, which is a successor to the Regional Geometry Institutes.

Taken together, these diverse constituencies in the mathematics and mathematics education communities have established a proud record of innovative and constructive leadership in education reform at all levels. This is reflected in the privileged status that was given by former National Academy of Sciences President Frank Press to MSEB. The best tribute to this performance is that it is recognized and now even being emulated by the science community. Further, it is cited as a model by funding agents, both governmental and from foundations. Mathematics has, until now, been the pioneer and flagship of education reform efforts.

Science Education Reform (“The new kid (bully?) on the block”)

The education programs at the NRC, which the MSEB inaugurated, depart from the National Academy traditions in

two significant ways. First, they go well beyond the direct training of scientific professionals to embrace the full spectrum of mathematics and science education, K–postdoctorate, with an early emphasis on K–12, where few Academy members can claim much scholarly authority. Second, the activities go beyond the production of expert studies and reports to include proactive efforts toward implementation. This stretched the customary, tightly controlled practices at the NRC, creating tensions that persist to this day. But overall, the success of MSEB activities, and the urgency of the national problem being addressed, won high esteem and a prominent place for education reform at the NRC. It was therefore desirable—indeed, inevitable—to expand those activities to address science education reform as well.

While science education reform has emulated many of the strategies of the mathematics reform movement, in particular the development of national standards for curriculum, pedagogy, and assessment, there are some significant differences. Instead of treating one, intellectually coherent discipline, science has to cope with a multiplicity of disciplines, with different outlooks and methodologies, sharing mainly the fact that they are focused on aspects of the same natural universe. The task of creating an integrated framework for all of these is therefore formidable. In addition, unlike the math community, several stakeholders—the science teachers, then the American Association for the Advancement of Science with its Project 2061, and finally the NRC Science Standards project—started off somewhat independently, each making some claim to the territory. This created some political tensions, which have now been more or less resolved. The math community had the wisdom to recognize the importance of creating consensus and buy-in by all of the stakeholders from the beginning and so avoided this kind of problem. At the moment, the major effort is the NRC Science Standards project. It is a huge and complex enterprise, now in a very intense drafting and review process. The Science Standards should be publicly released within the coming year. This will be an occasion of much fanfare and public discussion and debate, during which science education will be center stage.

But already at the Academy, many important recent events have changed the whole picture of the education programs at the NRC. Most important is the arrival of Bruce Alberts as the new Academy president. He is a distinguished molecular biologist from the University of California at San Francisco who has spent six years on a project to infuse science education into the schools in the San Francisco system by connecting biological scientists with some of the outstanding elementary science teachers in the system. He has formally placed K–12 education reform at the top of the NRC agenda, but with a focus on science education and even with a strong inclination toward the life sciences. Moreover, he strongly favors methods of direct local intervention such as those in his San Francisco project, methods which contrast sharply with the strategy of national policy study and institutional brokering that characterized the MSEB efforts. (The MSEB has always felt that outside agents were better qualified and more appropriate than it is for local intervention projects.)

The second major change was that the NSF cut in half the NRC request for continued funding of its programs in education and at the same time recommended that all NRC education work, including the MSEB, be merged into a single Coordinate Council for Education (CCE); this has been done, and the CCE is now chaired by Bruce Alberts himself. One consequence of this new “cooperative agreement” between NSF and NRC is that the outreach programs of the MSEB, such as the State Coalitions and Equity and Diversity Programs, which deal with matters not unique to mathematics, were moved from MSEB into the larger CCE environment to emphasize science as well as mathematics education. Therefore MSEB now works with a diminished staff, agenda, and influence at the NRC, though it still carries a lot of stature because of its track record and the very high quality of its staff and Board members.

The third major change was the loss of Ken Hoffman, who provided much of the creative genius in launching MSEB and the whole NRC education portfolio, who was executive director of the CCE until his departure, and who, in the past, was the organization’s main problem solver and strategist. We all owe Ken Hoffman a great debt for his fundamental contributions, all the more keenly felt in his absence.

Let me observe here a significant difference between the culture of school education and that of scientific research in America, one that bears directly on the transformations that I am describing. In school education, of all of the combined math and science teaching, over half, in terms of both student and teacher hours, is in mathematics; and mathematics is even more preponderant in the early grades. This is reflected in a much more highly developed professional organization of mathematics teachers as well. In the science research community, which is what the National Academy of Sciences represents, mathematics is, in contrast, a very small player. In many activities in which mathematicians participate alongside scientists, the mathematicians tend to get marginalized. I won’t attempt here to analyze the (interesting) reasons for this, but I do wish to emphasize its consequences for our education efforts when they are placed in the custody of an organization like the NRC as presently constituted.

The Stake of the Mathematics Community

The lengthy and rather tortuous negotiations with the NSF over the new NRC education proposal placed the NRC education programs, and MSEB especially, in a precarious state of uncertainty about the future. This occasioned some real soul searching. The MSEB was brought into existence formally by a petition from the mathematics and mathematics education communities, represented by the Conference Board on Mathematical Sciences, to the NRC, then chaired by Frank Press. In this light, the MSEB is the progeny of the math communities but placed in the custody of the NRC. We felt it appropriate therefore to engage the professional societies that are mainly concerned with education—AMATYC, AMS, MAA, NCTM, and SIAM—to discuss whether, in the event that support from the NSF and/or NRC should deteriorate, the math communities had a stake in the survival of something

like the MSEB; and, if so, whether it should continue to be lodged at the NRC. In fact, the temporary crisis that precipitated those discussions has been satisfactorily resolved for the time being, so no hard choices had to be made.

But the event was, nonetheless, significant in several ways. First, it produced a conviction that there remained an important role for the MSEB. Further, it was concluded that there are overriding advantages for its effectiveness to remain at the NRC. Nonetheless, the professional societies, acting in concert, were prepared to act as supportive agents in appropriate ways and in partnership with the NRC when feasible. In fact this took tangible form when the AMS, MAA, and NCTM funded the spring meetings of our panels on Higher Education and on Equality and Diversity, whose budgets had not survived the NSF negotiation process. AMATYC also provided some in-kind resources. Moreover, JPBM served as host for a grant from the Dana Foundation for an MSEB report to the professional societies to help them determine a coordinated agenda to improve the mathematical preparation of K–6 teachers. Further, the presidents of the above five societies formally met with Bruce Alberts last spring to discuss matters of common interest and possible means of cooperation.

Though these gestures came as part of a crisis intervention to give temporary relief to MSEB, they represent a historically unprecedented event. For the first time, organizations ranging from AMS to NCTM were engaged in a genuine partnership for shared educational concerns. This, to me, was the most significant outcome of the episode, one that presents an important opportunity, should we choose to seize it. Our collective communities, as represented by these societies, were able to act in concert and speak with one voice. That is a powerful and precious asset that I feel we should not lose.

The success so far of the K–12 mathematics education reform effort owes much to the consensus and community cohesion on which it was founded. Now that the reform activity is moving more vigorously into the higher education arena, it is natural to ask whether we might achieve a similar cohesion at this level. If this could be done, then the force of collectively orchestrated action would become much more than the sum of its parts, and it could do much to restore the leadership position in education that the math communities have earned but are now threatened with losing in the tide of science education reform and changing policies at NSF.

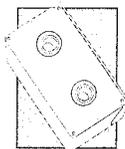
There are cultural and organizational barriers to achieving this, as the following observations illustrate. Relations between mathematicians (AMS) and teachers (NCTM) have, in the past, been characterized by condescension on one side and defensiveness or feelings of intimidation on the other. The historic decision to make the AMS and MAA separate organizations has created a disposition for the AMS to circumscribe its education activities in part for fear of treading on MAA territory. Thus, while education tends to be a landscape with no prominent intrinsic boundaries, our organizational culture has erected fences that inhibit holistic approaches to its problems.

I would like to see a plan of action in higher education

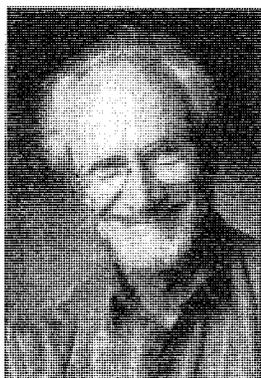
that exhibits some of the characteristics that has made the K-12 effort so successful. Thus, in place of the MSEB partnership with NCTM, and with the State Coalitions as outside leadership agents, one might imagine a similar arrangement of MSEB with a loose but ideologically cohesive educational partnership of the five professional societies mentioned above, and with MER, together with the research institutes, in a role

somewhat analogous to that of the State Coalitions. This might be difficult to broker, and the precise structure appropriate for its implementation is not clear. But the first, and crucial, question is whether the mathematics communities stand ready to support the concept.

That is the thought I wish to leave with you now.



V I D E O T A P E S



In Search of Symmetry, *William Browder*

William Browder served as President of the American Mathematical Society during 1990-1991. This videotape contains his Retiring Presidential Address—preceded by an informal interview in which he discusses a range of topics, including public awareness of mathematics. The lecture discusses the action of finite groups on manifolds, exploring the question of how large a finite group can effectively act on a given manifold. Browder concentrates on familiar examples such as the sphere, the n -sphere, or a product of spheres of different dimensions. The lecture is accessible to mathematics majors with background in algebraic topology.

1991 *Mathematics Subject Classification*: 55
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The Current Interface of Geometry and Elementary Particle Physics, *I. M. Singer*

This lecture covers three intriguing examples of interactions between physics and geometry: (i) the use of mirror symmetry in a conformal field theory to enumerate rational curves on a quintic, (ii) the Kontsevich matrix model that led to a solution of a conjecture of Witten, and (iii) the Jones-Witten knot invariant and Chern-Simons quantum field theory. The lecture is preceded by an interview with Singer. Providing insight on one of the hottest topics in mathematics, as well as a personal look at one of the leaders in the field, this videotape will interest students and researchers in mathematics, physics, and the history of science.

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Edited by Keith Devlin

This month's column

George Grätzer continues with his series of articles on \LaTeX . The previous article in the series appeared in the September *Notices*. Raj Markanda reviews the latest version of *Mathcad* for Windows and Larry Riddle reports on *TEMATH*, Version 1.5.

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Advances in \TeX .

V. Using text fonts in the new standard \LaTeX

George Grätzer*

Introduction

In [3], we gave a brief look at the experimental release of $\text{\LaTeX} 2_{\epsilon}$. In June of 1994, the new standard \LaTeX ($\text{\LaTeX} 2_{\epsilon}$ or \LaTeX Version 2 ϵ) was released. The major change from \LaTeX Version 2.09 to the new standard \LaTeX is the incorporation of the New Font Selection Scheme (NFSS).

This article and its continuation, Part VI (which deals with math fonts), describes the NFSS (as it is incorporated in the new standard \LaTeX) from a user's point of view. Writers of macro packages and style sheets need a more in depth look than what is presented here; they should read Michel Goossens, Frank Mittelbach, and Alexander Samarin [1]—especially Chapters 7 and 11.

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This release should soon be followed by Version 1.2 of \AMS-LaTeX which will be based on the new standard \LaTeX . I hope that this article and its continuation, Part VI, will suffice for the readers of [5] to change to the new version of \AMS-LaTeX .

Good news

If you are a typical mathematician whose interest is to produce articles to be submitted to journals and conference proceedings, and you use a \TeX setup with the *Computer Modern* fonts in pk files, then **there is very little** (if any) you have to learn. You are used to changing the shape of the font with two-letter commands: `\bf`, `\em`, `\it`, `\rm`, `\sc`, `\sf`, `\sl`, `\tt`; and the size with commands from `\tiny` to `\Huge`.

The good news is that you can continue working as you have been doing, and despite the huge changes behind the scenes, (most) everything will work out as expected.

There is a subtle change in the definition of these commands in the new standard \LaTeX (see Section 3); however, chances are that this will not affect your everyday work.

One of the most important aspects of the NFSS is the ease of use of outline fonts. Since some mathematicians do not seem very fond of *Computer Modern* fonts, it seems safe to assume that many will switch to the use of standard PostScript fonts (such as *Times*). (We discussed the problem of choosing math fonts to go with PostScript fonts in Section 10 of [3].)

This is made easy by the PSNFSS system by Sebastian Rahtz (which is part and parcel of NFSS). After the `\documentclass{article}` you just add `\usepackage{times}` and your article will be typeset in the text font *Times*. `\sf` then switches to *Helvetica* and `\tt` to *Courier*. A number of such style files come with PSNFSS.

Font characteristics

The font family presently used is the *Computer Modern* upright (Roman) font `cmr`. You can change the

- **shape** to *slanted*, to *italics*, and to SMALL CAPS;
- **weight and width** to **bold extended**;
- **size** from `tiny` to `Huge`.

Any \LaTeX user is familiar with *shape* and *size*.

Weight and width are somewhat less familiar because they are not much used with *Computer Modern* fonts. *Weight* refers to thickness of the strokes; it ranges from Ultra Light, through Medium (normal), to Ultra Bold. *Width* is the contraction or expansion compared to the normal font; it ranges from Ultra Condensed, through Medium (normal), to Ultra Extended. Note that **example** is thicker and somewhat wider than example; witness:

example (bold extended)

example

example (bold)

(Recall that \LaTeX , traditionally, when asked for bold, provides bold extended.)

There is one more attribute, font encoding, which we shall not discuss.

It is a basic design goal of the NFSS to be able to change these characteristics *independently*. For instance, in \LaTeX Version 2.09, `\large` specifies “large” letters in the upright (roman) style. So to get large bold letters, you have to give the commands `\large \bf` and not `\bf \large`. In NFSS, `\large` only changes the size attribute; it leaves the shape (and everything else) unchanged. So in the new standard \LaTeX , `\large \bfseries` and `\bfseries \large` have the same effect.

The high-level interface

There are ten standard high-level size-changing commands in the new standard \LaTeX , just as in \LaTeX Version 2.09: from `\tiny` to `\Huge`. ($\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX implements them all but they are not all of different sizes.)

There are eleven pairs of high-level commands to select font family, shape, and weight and width.

The three document font families

The style designer picks three document font families:

- the document font family, or upright document font family;
- the sans serif document font family;
- the typewriter style document font family.

When we use *Computer Modern* fonts, these are `cmr` (*Computer Modern Roman*, the font family we are using), `cmss` (*Computer Modern sans serif*, as in example), and `cmtt` (*Computer Modern typewriter*, as in example).

If you use the *times* style, invoked with the command `\usepackage{times}` then the upright document font family is *Times* (`ptm`), the sans serif document font family is *Helvetica* (`phv`), and the typewriter style document font family is *Courier* (`pcr`).

When you first start typing text in a document, you use the upright document font family. You can always switch back to it with

`\textnormal{...}` or `{\normalfont ...}`

There are three pairs of commands to help you switch among (and to) the three basic document font families:

`\textrm{...}` and `{\rmfamily ...}` switch to the upright family.

`\textsf{...}` and `{\sffamily ...}` switch to the sans serif family.

`\texttt{...}` and `{\ttfamily ...}` switch to the typewriter style family.

Command pairs

As you can see, all the commands of this section come in two forms.

- A command with an argument, as `\textrm{...}`; this command effects the change in its argument.
- A command without argument, as `\rmfamily`; this command carries out the switch.

The first type of commands have an advantage: if an italic correction is needed, it is automatically supplied. So instead of the usual

Now we shall `{\itshape italicize\}` some text we can do the following:

Now we shall `\textit{italicize}` some text

This is especially useful with the `\emph` command.

Weight and width

These attributes are usually controlled with the low-level interface: there are nine weights (from Ultra Light to Ultra Bold) and nine widths (from Ultra Condensed to Ultra Expanded) yielding 81 possible pairs. The high-level interface gives only two command pairs:

`\textmd{...}` `{\mdseries ...}`

which set both weight and width to medium (normal), and

`\textbf{...}` `{\bfseries ...}`

for bold.

The second pair of commands needs some clarification. In \TeX , \LaTeX , and $\mathcal{A}\mathcal{M}\mathcal{S}$ - \LaTeX , when we ask for bold with `\bf`, we do not switch to the *Computer Modern* bold font family (`cmb`) but to the bold extended family (`cmbx`). So if the document font family is *Computer Modern*, then switching to bold must switch to bold extended. On the other hand, if the document font family is *Times*, then switching to bold must switch to bold (firstly, because this is what we want; secondly, because the typical *Times* family has no bold extended variant).

The new standard \LaTeX resolves this problem with an elegant trick: `\textbf` (and `\bfseries`) switches to `\bfdefault` which is defined in the usual (*Computer Modern* font family based) style sheets as `bx` (bold extended) but which is defined as `b` (bold) by the *times* style.

Shape commands

There are five pairs of commands to change the font shape.

- `\textup{...}` and `{\upshape ...}` switch to the upright (roman) shape.
- `\textit{...}` and `{\itshape ...}` switch to the *italic shape*.
- `\textsl{...}` and `{\slshape ...}` switch to the *slanted shape*.
- `\textsc{...}` and `{\scshape ...}` switch to SMALL CAPITALS.
- `\emph{...}` and `{\em ...}` switch to the *emphatic shape*.

Two-letter commands

The two-letter commands we have been using in \LaTeX Version 2.09 and $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{T}\mathcal{E}\mathcal{X}$ (`\bf`, `\em`, `\it`, `\rm`, `\sc`, `\sf`, `\sl`, `\tt`) are not part of the new standard \LaTeX ; however, they are defined in the most often used document classes for compatibility reasons. They are defined

- to switch to the document font;
- to change to the appropriate shape.

So if the document font family in your article is *Computer Modern*, and you select, say, the *Helvetica* font for the paragraph,

```
{\bf this is bold}
```

will be typeset in *Computer Modern* bold.

To switch to bold, use the low-level command:

```
\fontseries{b}\selectfont
```

The low-level interface and font definition files

The low-level interface changes font attributes with the `\selectfont` command. With a few exceptions, this should be used by package writers, style designers, and so on, and ignored by users.

There are a few exceptions to this rule. One was noted in Section 4.5.

Another is choosing a new font family. Say we would want the next few lines in *Helvetica*. Then we need the command `\fontfamily{phv}\selectfont`

Normally font families are harmonized by package writers; we have mentioned the `times` package which brings together *Times*, *Helvetica*, and *Courier*. In such a package, you switch font families with high-level commands.

Sometimes we need fonts in an unusual font size or an unusual baseline skip. For instance, the designer of the book [5] decided to use 10 pt *Times*—not with the usual 12 pt but with 13 pt baseline skip. The command for this is `\fontsize{12}{13}\selectfont`

When the new standard \LaTeX needs a font family, it turns to a “font definition file” (fd file) to find information about the font family.

For instance, if you want to use the *Times* font, you invoke the `times` style file, which will inform the new standard \LaTeX that the upright font family should be *Times*, that is, `ptm`. Then the new standard \LaTeX turns to the `ptm` font definition file (called `OT1ptm.fd`) which translates the font family requests to names \TeX will understand. A typical line in such a file is `\DeclareFontShape{OT1}{ptm}{m}{n}{<->Times}{}` which says that for all sizes (<->) use *Times*.

Many users of \TeX utilize the PostScript rendering of the *Computer Modern* fonts from Blue Sky Research and Y&Y. When this font family was rendered in PostScript, only some of the sizes were done. These users will need modified fd files from the vendors before they can use the new standard \LaTeX .

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- [1] Michel Goossens, Frank Mittelbach, and Alexander Samarin, *The \LaTeX Companion*, Addison-Wesley, Reading, Massachusetts, 1994.
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- [3] ———, *Advances in \TeX implementations. III. A new version of \LaTeX , finally*, Notices Amer. Math. Soc. **41**(6) (1994), pp. 611–615.
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- [5] ———, *Math into \TeX . A simple introduction using $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{T}\mathcal{E}\mathcal{X}$* . Birkhäuser Boston, 1993.

Reviews of Mathematical Software

Mathcad 5.0 Plus for Windows

Reviewed by Raj K. Markanda*

Mathcad has been under development by Math Soft Inc. since 1985. Its versions 2.03 and 3.1 have been reviewed in [1] and [2]. So I will give a brief review of the version. It has some new features: zooming of plots, spell checker, print preview, improved equation editing, an animated tutorial, solving equations symbolically etc.

Mathcad can be used to work with formulas, numbers, text, and graphs. One can mix text, mathematics, and graphs anywhere on the screen by choosing Cut, Paste, and Copy from the Edit menu. But it is difficult to align text and mathematics as one wants them. One can also determine the font, size, and style used for numbers and letters. The screen looks like standard mathematics. It is easy to enter subscripts, superscripts, etc. as the user’s guide provides a list of *Mathcad* operators and most of these are available through the symbol palette.

Mathcad has a built-in solver for simultaneous equations and inequalities. One can work with matrices using a variety of functions provided by *Mathcad*. It is easy to create a matrix and find its rank, norm, eigenvalues, eigenvectors, LU or QR decomposition. Numerical calculus can be done using *Mathcad*’s differential and integral operators. There are statistical functions for population statistics, probability distribution, correlation, linear and non-linear regression regression, etc. It has interpolation, predictive, and discrete transform functions and several functions, based on different methods, which return a numerical solution to a differential. One may have to try several methods on the same differential equations to see which works the best. The `relax` function provides a solution of a partial differential equation.

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Mathcad's symbolic processor is based on the well-known computer algebra system *Maple*, developed by Waterloo Software Inc. It can perform most symbolic algebra and calculus operations. *Mathcad's* graphing capabilities include graphing of vectors, surface, contour, and polar plots. Surface plots are created by defining a matrix of values. *Mathcad* then draws this matrix as a two-dimensional grid lying flat in three-dimensional space. Another interesting feature of *Mathcad* is SmartMath. It is based on an expert system tool, C Language Integrated Production Systems, developed by NASA's Artificial Intelligence Section. When SmartMath is turned on, a set of rules become available which is turn make it possible for *Mathcad* to determine how best to combine its symbolic and numerical capabilities. Unfortunately it was not very helpful in evaluating certain definite integrals.

Mathcad has several electronic handbooks with standard formulas, constants, and diagrams. A handbook can be opened within *Mathcad* and one can experiment inside the electronic book and then paste the results back into a *Mathcad* document. This is very useful for science and engineering researchers and students.

We give below some examples to display some important features of *Mathcad*.

Example 1

Solve $x^3 - 2x - 5 = 0$

Method 1. $x := 1$

$$\text{root}(x^3 - 2x - 5, x) = 2.095$$

Method 2. To get all roots use polyroots functions or the symbolic processor.

$$v := \begin{pmatrix} -5 \\ -2 \\ 0 \\ 1 \end{pmatrix}$$

$$\text{polyroots} := \begin{pmatrix} -1.047 + 1.136i \\ -1.047 - 1.136i \\ 2.095 \end{pmatrix}$$

Method 3. Click on x and use the symbolic solver to get exact solutions or replace 5 by 5.0 to get numerical approximations.

Example 2

Find the formula for the sum

$$\sum_{i=1}^k i^3$$

Using the symbolic processor we get:

$$\frac{1}{4}(k+1)^4 - \frac{1}{2}(k+1)^3 + \frac{1}{4}(k+1)^2$$

Example 3

Find the intersection of a line and a circle.

$$x := -5$$

$$y := 1$$

$$\text{Given } x^2 + y^2 = 6$$

$$x + y = 2$$

$$x \leq 1$$

$$\text{Find } (x, y) = \begin{pmatrix} -0.414 \\ 2.414 \end{pmatrix}$$

Example 4

Solve $\frac{a+bc}{c-b} = a^2$ for a .

Clicking on a and using the symbolic processor, we get

$$\frac{1}{2(c-b)} + \frac{1\sqrt{1+4bc^2-4b^2c}}{-c+b}$$

Example 5

Find the Taylor series of order 9 of $\cos(x)$.

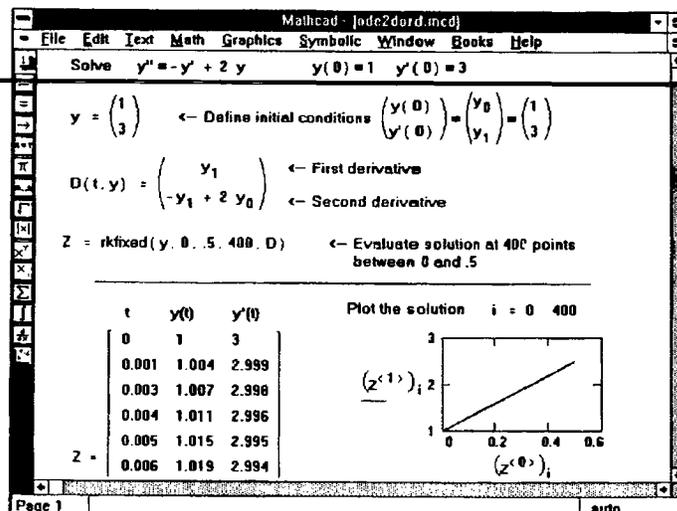
Click on x and use the symbolic processor.

Example 6

Evaluate $\int (\sin(xy) + \frac{1}{x^2+4}) dx$

One can use the integral operator or the symbolic processor to get the answer.

Example 7



Conclusions

Being familiar with *Derive*, *Maple*, and *Matlab*, I am using *Mathcad* for the first time. For the purpose of this review, it took me one week to learn its basic operations. *Mathcad's*

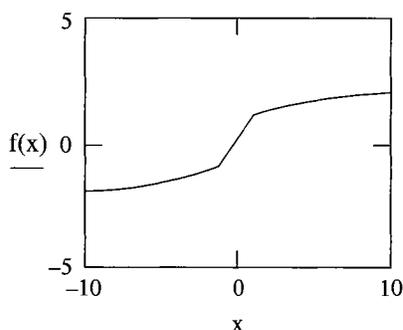
user's guide is well written and user friendly. It functions both as a reference and tutorial for learning the features of *Mathcad*, including many examples covering a variety of topics.

Mathcad's symbolic processor has a limited number of symbolic tools, despite being based on a *Maple* symbolic engine. Due to the limited tools, it did not give a symbolic solution to the equation $\frac{dy}{dx} = y$ or solve the equation $y = \text{series}(xe^x)$ of order 3.

Maple does solve both equations. The output of a surface graph is small and sometimes lacks details and contrast and a 200% zoom of the graph is too large for the viewscreen. A 75% zoom followed by a 200% zoom is a better option in this situation. For some reason, an odd root of a negative number is displayed as a complex number and hence graphs involving odd roots do not come out right. For example:

If $g(x) = x^{1/3}$ then *Mathcad* returns $g(-8) = 1 + 1.732i$
This can be modified by defining a new function:

$$\begin{aligned} f(x) &:= \text{if}[x > 0, x^{1/3}, -(-x)^{1/3}] \\ f(-8) &= -2 \\ f(-1.2) &= -1.063 \end{aligned}$$



In general, if

$$h(x) := (1 - x^5)^{1/7} \text{ then } h(1.2) = 0.954 + 0.459i$$

This can be modified by defining the following function:

$$\begin{aligned} k(x) &:= \text{if}[x < 1, (1 - x^5)^{1/7}, -[(|1 - x^5|)^{1/7}]] \\ k(1.2) &= -1.058 \end{aligned}$$

System Requirements:

Mathcad 5.0 requires a 386 or 486 IBM or compatible PC and at least an 8 MB RAM and 17 MB of free hard disk space. 8 MB of virtual memory and a math coprocessor are recommended. The author used a 66MHz 486DX2 PC. *Mathcad* costs approximately \$299 and is available from most educational software dealers or directly from Math Soft Inc., 101 Main St., Cambridge, MA 02142; 800-628-4223.

References

[1] Mary Beth Ruskai, *Mathcad 2.03*, Notices Amer. Math. Soc. **37** (1990), p. 15.

[2] William H. Ruckle, *Mathcad 3.1*, Notices Amer. Math. Soc. **40** (1993), pp. 26–28.

TEMATH, Version 1.5

Reviewed by Larry Riddle*

TEMATH, described as a set of tools for exploring mathematics, consists of integrated modules for graphing rectangular, polar, and parametric functions, working with data, and working with matrices. Developed by Robert Kowalczyk and Adam Hausknecht at Southeastern Massachusetts University for use by students in, for example, precalculus, calculus, or linear algebra, the program runs on any Macintosh with at least 1 MB of memory and system version 6.0 or later. It is published by Brooks/Cole Publishing Company, 511 Forest Lodge Road, Pacific Grove, CA 93950-5098 (408-373-0728 or info@brookscoble.com).

I teach my mathematics courses using the graphing program *Plot* for the IBM PC, written by Richard Parris at Phillips Exeter Academy. At home, however, I use a Macintosh to explore mathematical ideas for use in my classes and to prepare materials for student assignments and projects. It has been within this context that I have used *TEMATH* for several months.

Most users of *TEMATH* will primarily exploit the program's tools for exploring graphs of functions in rectangular, parametric, or polar mode. For drawing the graph of a function in rectangular coordinates, the authors have incorporated many of the same ideas as found in some of the major symbolic algebra systems such as *Mathematica*. For example, the default mode for drawing the graph is to use an adaptive plotting method that selects a higher density of points for plotting where the curve changes rapidly, and a lower density of points where the curve changes slowly. The extremes of the drawing window may be manually set by the user or the range may be autoscaled by the program. In the latter case, if the value of the function becomes very large in absolute value near either endpoint of the domain, the adaptive graphing algorithm will try to find a scale for the vertical axis that emphasizes the most interesting behavior of the function within the specified domain.

Figure 1 shows the results of an exploration based on a precalculus project. I asked each student to construct a rational function by using the first five digits of his or her social security number to form the polynomial in the numerator, and the last four digits to form the polynomial in the denominator, with the signs of the coefficients alternating. The goal of the project was to investigate as many different properties of the rational function as possible, such as asymptotes, global behavior, zeros, turning points, etc. As one can see in the figure,

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TEMATH's interface consists of four principal windows for entering the functions, specifying the domain and range to be used in graphing, drawing the graphs, and receiving reports about TEMATH's computations. All four windows should be visible for the most efficient use of the program, and this requires judicious use of sometimes limited screen space. Fortunately, the windows' positions and sizes can be saved in a preference file once you have them arranged to fit your monitor.

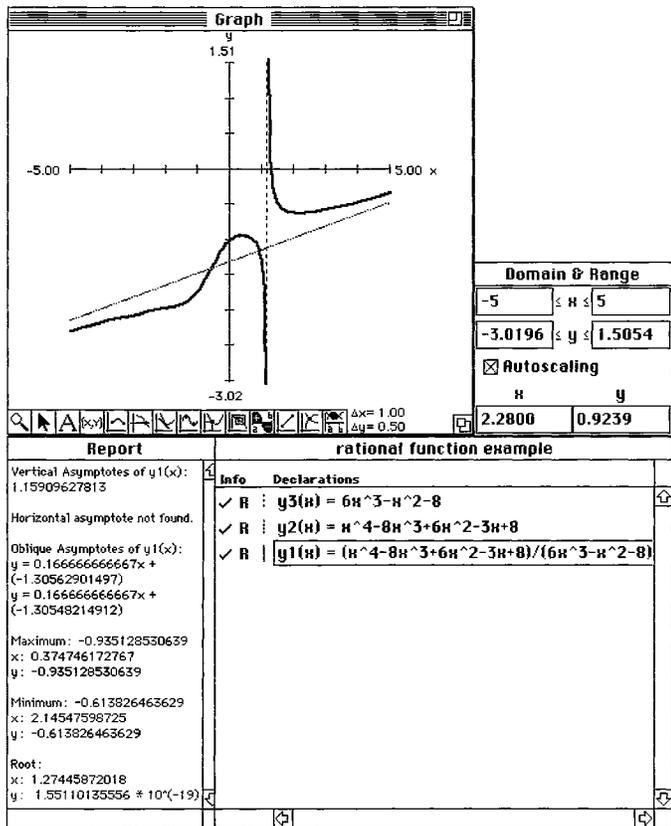


Figure 1

The rational function displayed in Figure 1 has one vertical asymptote which TEMATH identified and graphed when the program drew the graph of the function. Choosing the menu item Other Asymptotes found the oblique asymptote, but notice that two results were given in the Report window. The actual value for the constant term of the line $> 47/36 \Rightarrow 1.3055555 \dots$ is the average of the two constant terms reported by the program. This problem arises because TEMATH "evaluates" limits numerically and must then decide when two floating point numbers should be regarded as equal. In this case, one partial solution is to use the Accuracy menu option to set the accuracy that TEMATH uses in computations and display to a value less than 9 significant digits (the default is 6 digits, but I had set the value to 12 before investigating this function). The program will then report only one oblique asymptote for this example.

A rectangular tool palette appears along the bottom of

the Graph window for use in the exploration of the graph. To locate the relative maximum and minimum values of my function, I selected the Maximum/Minimum Finder tool (the eighth icon in the row), then clicked on the graph near the two locations where I expected to find the points. The results from the program are displayed in the Report window. Similarly, I chose the Single Root Finder tool (the fifth icon) and then clicked on the graph to locate the zero between $x = 1$ and $x = 2$. I could also have selected the function $y2(x)$ in the lower right Work window, increased the right endpoint for x in the domain window, and then plotted just the numerator to verify that the rational function has only two zeros and to locate these zeros using either the Single Root Finder tool or the Root Finder menu item (which tries to locate all roots within the specified domain).

Some of the other tools on the rectangular tool palette allow the user to zoom in on part of a graph, add text to the graph window, trace along the curve, compute numerical derivatives and tangent lines, find the intersection of two curves, compute arc length, and perform numerical integration.

TEMATH has several distinctive features that make the program particularly useful for visual explorations of the graphs of polar and parametric functions. The Parametric Tracker Tool provides a slide bar along the right edge of the graph of a parametric function. As you change the parameter value by dragging the box in the bar, a large dot dynamically moves along the curve to indicate the corresponding (x, y) coordinate. Even better, however, is if several parametric functions are graphed on the same axes. Then the dots on each curve move simultaneously as you dynamically change the parameter value! Figure 2 shows a circle and an ellipse with the slider positioned at $t = 2.4288$. What you cannot see in this static picture (but should be able to predict from the form of the parametric equations) is that as you move the slide bar down with the mouse, the dot on the circle will move in the counterclockwise direction while the dot on the ellipse

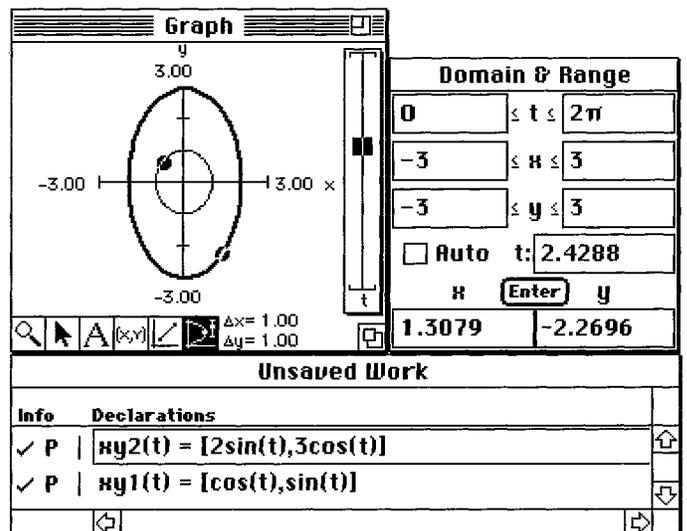


Figure 2

will move in the clockwise direction. If there was only one feature of *TEMATH* that I could import to my IBM graphing program, it would be this one.

Similarly, the Polar Tracker Tool provides a radial line on polar graphs that represents the angle measured from the polar axis. As you drag this radial line around the origin, a large dot moves along each plotted polar curve to indicate the respective points corresponding to that value of the angle. Polar graphs may even be plotted on top of a grid that imitates polar graph paper.

Other components of *TEMATH* allow the user to

- plot conics
- create a table of data either from the keyboard, with the mouse, or generated from a function
- plot the data in a table
- use the method of least squares to fit a table of data points with a line or with a polynomial, exponential, power, logarithmic, hyperbolic, or rational function
- compute the interpolating polynomial for a table of data points
- do matrix calculations on matrices of maximum size twelve by twelve.

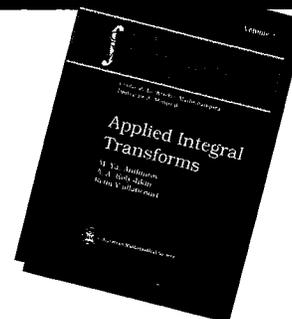
TEMATH is very easy to learn and use. My main frustration arose when switching between the various windows. This usually required two mouse clicks, one to activate the window and then a second to position the cursor or select an item in the window. I would prefer if both operations could be done with a single mouse click. I never experienced any crashes while using *TEMATH*. The program comes with a well-written and illustrated 200-page guide that explains all the features and describes several examples of explorations involving graphs, data, and matrices. Unfortunately, the manual is still from version 1.0 and the new features of version 1.5 are covered in Xeroxed pages included in the package. These extra pages are very easy to misplace or lose. I speak from experience. Adequate on-line help is also available if the manual is not readily available, such as in a laboratory setting.

The single-user price for the program is \$75 and site licenses are available for \$200 plus \$10 per machine. A free demonstration package is available by contacting Brooks/Cole.

CRM MONOGRAPH SERIES

Applied Integral Transforms

M. Ya. Antimirov, A. A. Kolyshkin,
and Rémi Vaillancourt
Volume 2



This book does what few books on integral transforms do: it constructs the kernels of the integral transforms by solving the generalized Sturm–Liouville problems associated with the partial differential equations at hand. In the first part of the book, the authors construct the kernels and then use them to solve elementary problems of mathematical physics. This section, which proceeds mainly by examples and includes exercises, requires little mathematical background and provides an introduction to the subject of integral transforms.

In the second part of the book, the method of integral transforms is used to solve modern applied problems in convective stability, temperature fields in oil strata, and eddy current testing. The choice of topics reflects the authors' research experience and involvement in industrial applications. Because of the applications it discusses, the book will interest engineers (especially petroleum engineers) and physicists.

The CRM Monograph Series is jointly published by the American Mathematical Society and the Centre de Recherches Mathématiques.

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Inside the AMS

Ivar Stakgold

Heads AMS Washington Office

Ivar Stakgold of the University of Delaware has accepted the position of head of the AMS Washington Office. Stakgold served as president of the Society for Industrial and Applied Mathematics and as chair of the Conference Board of Mathematical Sciences, giving him extensive experience as an advocate for the mathematical sciences community. He is an internationally known researcher in nonlinear boundary value problems, particularly of the reaction-diffusion type.

"I am very enthusiastic about taking on this challenge," says Stakgold. "I hope to help connect the mathematical sciences community to the Washington scene and increase recognition of the important contributions that mathematicians make to society."

Stakgold received his Ph.D. in 1949 from Harvard University, where his advisor was Leon Brillouin. He was an assistant professor and instructor at Harvard until 1956, when he became the head of the Mathematics Branch and the Logistics Branch of the Office of Naval Research (ONR) in Washington, DC. In 1960 he took a joint appointment in the Department of Engineering and the Department of Mathematics at Northwestern University, where he remained until 1975. During 1967–1969 he was a liaison scientist at the London branch office of ONR. Since 1975 he has been a professor in the Department of Mathematical Sciences at the University of Delaware, where he served as chair until 1991. Stakgold will serve in the Washington office for the coming academic year, during which time a formal search for a permanent head will be held. His predecessor, John S. (Spud) Bradley, moved in August to the National Science Foundation as a program director in the education directorate in August.

"One important function of the Washington office is to make the case for mathematics with the decision makers in government and more generally with the public," Stakgold says. "There are many ways to do that. One is to reach out to Congress. Another is to help mathematicians who come to Washington to connect to Congress by providing them with materials, information, and guidance." Stakgold will work with federal agencies that fund mathematics research not only to try to improve the funding outlook for the field but also to "get mathematics in on the ground floor" of major research initiatives in which it has a contribution to make.

"Public support for mathematics is based mainly on its relevance," Stakgold says. "What is this relevance and how can we demonstrate it?" With respect to the first part of this question, Stakgold points to an article by Felix Browder and Saunders Mac Lane ("The Relevance of Mathematics" in *Mathematics Today*, Lynn Steen, editor, Springer-Verlag, 1978). "The customary division of mathematical research into pure mathematics and applied mathematics is not the most effective way to understand the relevance of mathematics," write Browder and Mac Lane. "One and the same mathematical idea can apply to totally different disciplines. One mathematical notion can arise initially in the context of 'pure' mathematics, only to find some later application. Conversely, some specific application may lead to a notion which later has a development within pure mathematics in quite different directions."

When it comes to demonstrating the relevance of mathematics, one of the difficulties is that the field is often "invisible": Mathematics has made decisive contributions to solving problems that are important to society, but these contributions are often buried deep inside the solutions. Stakgold says he will call upon the mathematical sciences community to come up with examples that reveal the foundational role mathematics has played in advances in science, technology, medicine, and other areas. "I would like to tie these examples to individuals and groups of mathematicians in particular states," he explains, so that Congressional representatives will recognize the contributions mathematics is making in their home states.

Stakgold points to the AMS National Policy Statement as an important tool for the Washington office. The statement sets forth goals for the mathematical sciences community in research, applications, education, and public awareness. "I was pleased with what the National Policy Statement says," Stakgold declares. "It has a sufficiently broad view of the responsibilities of mathematicians that I feel I can make a sincere case for the goals it outlines. I think it is a good document, and I am very comfortable working with it. For the work the Washington office does, it's just the right thing."

In raising public awareness of the importance of mathematics, the media play an important role. "The media are not unfriendly to mathematics at all," Stakgold says, pointing to the avid interest in Fermat's Last Theorem or topics

such as chaos. "I see more articles mentioning mathematics, not because we tried to sell it, but because mathematics is influencing more areas." Stakgold would like to try to raise awareness of "what mathematics does on a daily basis for society."

In addition to working on public awareness and Congressional liaison activities, Stakgold will also serve as the AMS staff contact for the Committee on Education. Being right next door to the Mathematical Association of America, downstairs from the office of the Conference Board of Mathematical Sciences, and in close range of the Joint Policy Board for Mathematics, Stakgold says he will cooperate with these organizations on activities of mutual interest. He would also like to look into the Washington activities of societies in other fields—such as the American Chemical Society and the American Institute of Physics—to see if some of their ideas would be useful for the AMS.

Stakgold invites interested members to send him their suggestions and to visit the AMS Washington office when the opportunity arises.

Allyn Jackson

AMS Electronic Mail Addresses

A number of non-user-specific electronic addresses have been established for contacting the AMS staff. The following is an updated list of those addresses together with a description of the types of inquiries that should be made through each address. Please note that the addresses for the AMS have changed from @MATH.AMS.COM to @MATH.AMS.ORG. For example, the address NOTICES@MATH.AMS.COM is now NOTICES@MATH.AMS.ORG. E-mail sent to an old address is currently being routed to the new address. However, it is anticipated that this rerouting will be discontinued after December 31, 1994.

If you communicate electronically with individuals at the Society, you should note that user-specific addresses have also changed to reflect the above address change.

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to request general information about Society meetings and conferences and for submission of electronic preregistration for the annual and summer meetings.

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to submit reviews to *Mathematical Reviews* and to send related correspondence.

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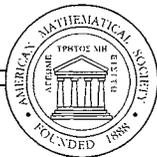
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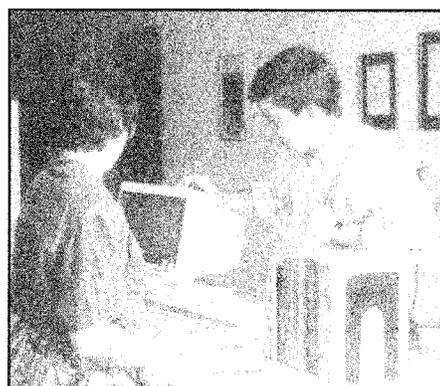
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News and Announcements

MAA Prizes Awarded at Mathfest

The Mathematical Association of America presented a number of prizes at the Minneapolis Mathfest in August.

The Carl B. Allendoerfer Award, which recognizes an expository article published in the *Mathematics Magazine*, was presented to JOAN P. HUTCHINSON of Macalester College for her article, "Coloring Ordinary Maps, Maps of Empires, and Maps of the Moon" (*Mathematics Magazine* **66** (1993), 211–226). "How can one say something fresh and interesting about a well-known and over-reported topic like the four-color problem?" the award citation asks. "Joan Hutchinson gives us a splendid reply. . . Professor Hutchinson's prose is crisp and direct, and the mathematics is essentially self-contained. All of the essential ideas are provided and explained in a clear and inviting fashion. The article offers both entertainment and enlightenment" to students and seasoned faculty.

Two George Pólya Awards recognized expository articles published in the *College Mathematics Journal*. One was presented to C. W. GROETSCH of the University of Cincinnati for "Inverse Problems and Torricelli's Law" (*College Mathematics Journal* **24** (1993), 210–217). "Using clear and careful reasoning, Groetsch draws surprising consequences about existence, uniqueness, and stability of solutions of indirect problems associated with Torricelli's Law for the flow of a liquid through a hole in a tank," the citation says. It goes on to call this "superbly written paper" a model for the kind of expository papers the *College Mathematics Journal* aims to publish.

The other Pólya Award went to DAN

KALMAN of American University for "Six Ways to Sum a Series" (*College Mathematics Journal* **24** (1993), 402–421). "Here is a fascinating look at an infinite series of historic significance—the series of reciprocals of the squares of the whole numbers—and at various methods of determining its sum," the citation says. "This paper demonstrates how the same destination can be reached by a variety of different routes and how a single topic, in the hands of a talented and enthusiastic writer, can yield unexpected mathematical riches."

Also presented were five Lester R. Ford Awards, which honor expository articles published in the *American Mathematical Monthly*. One award went to BRUCE C. BERNDT of the University of Illinois at Urbana-Champaign and S. BHARGAVA of the University of Mysore in India for their article, "Ramanujan for Lowbrows" (*American Mathematical Monthly* **100** (1993), 644–656). "Did Ramanujan ever do anything mathematical that ordinary mortals (lowbrows) have a chance of understanding?" the citation asks. "If the lowbrows are fond of numbers—plain old-fashioned positive integers—then the answer is yes. Ramanujan loved numbers, and the authors of this paper are specialists who admire Ramanujan's fertile imagination and his many amazing results. The paper presents a few small jewels from Ramanujan's crown."

LEONARD GILLMAN of the University of Texas at Austin received a Lester Ford Award for "An Axiomatic Approach to the Integral" (*American Mathematical Monthly* **100** (1993), 16–25). This paper discusses two axioms about integrals from which one can deduce all

other properties of integrals. "To show the ease and versatility of this natural approach, the author applies it to recapture the familiar formulas for length, and area, and volume," the citation says. "This is a charming paper, and there is reason to hope that it will charm beginners as well as grownups."

A Lester Ford Award was presented posthumously to EDGAR R. LORCH for "Szeged in 1934" (*American Mathematical Monthly* **100** (1993), 219–230); the award was presented jointly to REUBEN HERSH of the University of New Mexico, who served as editor of the article. The article is Hersh's adaptation of Lorch's fascinating recollections of a year spent in Szeged, Hungary. "Amusing anecdotes and mathematical gossip are combined with sincere appreciation and affection for the people and the period," the citation says. "Lorch and Hersh convey the Szeged experiences so vividly that readers feel like participants and can sense the excitement of the mathematical environment of the time."

JOSEPH H. SILVERMAN of Brown University received a Lester Ford Award for "Taxicabs and Sums of Two Cubes" (*American Mathematical Monthly* **100** (1993), 331–340). "This polished, amusing, and informative article has something for everyone, especially Ramanujan fans, number theorists, algebraic geometers, group theorists, and recreational mathematicians," the citation says. "So gently is the reader led along the garden path with each step explained clearly, we are roped in further and further, and then what it comes down to is an irresistible urge to study elliptic curves."

ISTVÁN SZALKAI of the Hungarian

Academy of Science and DAN VELLEMAN of Amherst College received a Lester Ford Award for "Versatile Coins" (*American Mathematical Monthly* **100** (1993), 26–33). The article explores "surprising consequences of the marvelously simple question: Which probabilities can be simulated by finitely many tosses of a biased coin?" the citation says. "The elementary yet complicated problems are so clearly solved that this essay could serve not only as a model of exposition but also as a source for classroom presentations or for further work by both students and faculty."

—From *Mathfest Prize Booklet*

AAUW Awards to Mathematicians

LISA A. MANTINI, associate professor of mathematics at Oklahoma State University, was the 1994 recipient of the \$25,000 Founder's Fellowship, the top award given to a woman scholar by the American Association of University Women (AAUW). She will use the grant to support her research on the representation theory of Lie groups during her 1994–1995 sabbatical year at the Institute for Advanced Study in Princeton, New Jersey.

The Founder's Fellowship is one of nine postdoctoral awards given annually by the AAUW to American women faculty members in all fields to support scholarship and promote equity for women in higher education. Six of these awards are given to new Ph.D.s and three are reserved for senior scholars. The award amounts range from \$20,000–\$25,000. Previous winners of fellowships from the AAUW, which has funded education and research by women for over one hundred years, include Marie Curie, Nobel laureate and the discoverer of radium, and Donna Shalala, secretary of the U.S. Department of Health and Human Services. Mantini is the only mathematician among the postdoctoral award winners this year.

The AAUW also awards fifty dissertation fellowships of \$14,500 annually to women graduate students who are completing the writing of their doctoral dissertations. Among the award winners this year are two women in the mathematical sciences: HEATHER JOHNSTON,

who is working on a doctorate in mathematics at the University of Chicago, and KAREN BELL, who is working on a doctorate in mathematics education at Boston College.

—Oklahoma State University

NSF Graduate Fellows Announced

The National Science Foundation has announced the names of awardees in its Graduate Fellowship Program for fiscal year 1994. The fellowships provide three years of support, and this year the twelve-month stipend will be \$14,000, with a cost-of-education allowance of \$8,600.

Out of a total of 950 awardees, fifty-four were in mathematics. For each awardee in mathematics, the following lists his or her name, mathematical area, baccalaureate institution, and proposed graduate institution (in parentheses). [Editor's Note: The institutions of graduate study listed here are from the original application forms. In many cases, the students will have switched institutions by the time the fellowship tenure begins.]

KASHI SHREERAM ABHYANKAR, topology, Purdue University (Massachusetts Institute of Technology); VICTORIA Z. AVERBUKH, operations research, New York University (Cornell University); DAVID DROR BEN-ZVI, geometry, Princeton University (Harvard University); JOSEPH ANTHONY BIELLO, applied mathematics, Columbia University (University of Cambridge, England); MICHAEL DAVID BOLT, topology, Calvin College (University of Illinois at Chicago); THOMAS JOSEPH BRENNAN, analysis, Princeton University (Harvard University); DAVID BRITTON CARLTON, algebra, Harvard University (Harvard University); CLAIRE ELIZABETH CATES, applied mathematics, University of Alabama (Cornell University); JOSEPH I-JEH CHUANG, algebra, Harvard University (University of California, Berkeley); DANIEL KEITH DUGGER, algebra, University of Michigan (Massachusetts Institute of Technology); DAVID IRVING FINBERG, no field given, College of William & Mary (Massachusetts Institute of Technology); IMOLA KATALIN FODOR, statistics, Rutgers University

(University of California, Berkeley); AMY CAROL GALTMAN, analysis, Brooklyn College, City University of New York (Stanford University); ALEX GAMBURD, applied mathematics, Massachusetts Institute of Technology (Massachusetts Institute of Technology); LAURA ANN GLENN, analysis, University of Wisconsin, Madison (Princeton University); REBECCA FREJA GOLDIN, geometry, Harvard University (Massachusetts Institute of Technology); SUSAN WENDY GOLDSTINE, algebra, Amherst College (Harvard University); THOMAS BENJAMIN GRABER, geometry, Harvard University (University of Illinois at Chicago); ALEXANDER JOHN HARTEMINK, analysis, Duke University (Harvard University); DANIEL CHARLES ISAKSEN, algebra, University of California, Berkeley (University of Illinois at Chicago); SHANNON MARIE KELLY, statistics, University of Washington (Cornell University); DARREN E. KESSNER, logic, University of California, Los Angeles (Princeton University); AARON ALAN KING, applied mathematics, Rice University (University of Arizona); SAMUEL ALAN KUTIN, algebra, Harvard University (University of Illinois at Chicago); TANYA LARISA LEISE, applied mathematics, Stanford University (Texas A&M University); STEVEN HWA LIN, statistics, Stanford University (University of California, Berkeley); DAVID ANDREW LIPPEL, logic, Haverford College (University of Wisconsin at Madison); MARK SPRUILL MACLEAN, analysis, North Carolina State University, Raleigh (Stanford University); DAVID TINDALL McMATH, applied mathematics, Rice University (Northwestern University); MICHAEL JAY METLER, applied mathematics, University of Central Florida (Texas Tech University); STEPHEN DAVID MILLER, topology, University of California, Berkeley (Princeton University); DAVID PETER NICHOLLS, applied mathematics, University of Illinois at Urbana-Champaign (Brown University); WALTER RICHARD O'CONNELL, Jr., applied mathematics, Virginia Polytechnic Institute & State University (Georgia Institute of Technology); CATHERINE HELEN O'NEIL, algebra, University of California, Berkeley (Harvard University); MATTEO JOHN PARIS,

geometry, Harvard University (University of Illinois at Chicago); ERICA LEE PLAMBECK, operations research, University of Wisconsin, Madison (Massachusetts Institute of Technology); JULIA JOY REHMEYER, topology, Wellesley College (Massachusetts Institute of Technology); DIMITRI Y. SHLYAKHTENKO, analysis, University of Nevada (University of California, Berkeley); LAWREN MICHAEL SMITHLINE, algebra, Harvard University (University of Illinois at Chicago); JOEL SCOTT SOKOL, operations research, Rutgers University (Stanford University); ERIC NATHAN SOMMERS, algebra, Brown University (Massachusetts Institute of Technology); BRETT C. STEVENS, algebra, University of Illinois at Chicago (University of Toronto); JOHANNA FRIEDA STOECKLER, applied mathematics, Brown University (Harvard University); CHRISTOPHER NOBLE SWANSON, topology, Denison University (Princeton University); FRANK JOSEPH SWENTON, algebra, Ohio State University (Princeton University); JAMES TURETSKY, geometry, Massachusetts Institute of Technology (Harvard University); JEREMY TAYLOR TYSON, analysis, Washington University (Princeton University); JEFFREY MARK VANDERKAM, analysis, Duke University (Harvard University); MONICA JOY VAZIRANI, algebra, Radcliffe College (University of California, Berkeley); MICHAEL KEVIN WEISS, no field given, University of Michigan (Princeton University); WALKER McMILLAN WHITE, algebra, Dartmouth College (Cornell University); KELLY LYNNE WIEAND, no field given, University of Wisconsin, Madison (Harvard University); CHRISTOPHER JAMES WIGGENHORN, statistics, University of Florida (Harvard University); and YIHAO LISA ZHANG, applied mathematics, Wesleyan University (Massachusetts Institute of Technology). -NSF

NSF Minority Graduate Fellows Announced

The National Science Foundation has announced the names of awardees in its Minority Graduate Fellowship Program for fiscal year 1994. The fellowships provide three years of support, and this year the twelve-month stipend will be

\$14,400, with a cost-of-education allowance of \$8,600.

Out of a total of 150 awardees, eight were in mathematics. For each awardee in mathematics, the following lists his or her name, mathematical area, baccalaureate institution, and proposed graduate institution (in parentheses). [Editor's Note: The institutions of graduate study listed are from the original application forms. In many cases, the students will have switched institutions by the time the fellowship tenure begins.]

KEVIN LEWIS HARTSHORN, topology, Notre Dame University and University of Indiana (Stanford Univ); ATIYA NATAKI HOYE, algebra, Spelman College (University of Maryland); DANIEL REUBEN KRASHEN, algebra, Oberlin College (University of Southern California); ALFRED LIN, statistics, Harvard University (Harvard University); SSEZIWA ANTHONY MUKASA, applied mathematics, Gordon College (Brown University); JAMES ANTHONY NUNEZ, algebra, University of California, Irvine (University of Illinois at Chicago); CRISTINA LEUBA PEREZ, applied mathematics, University of North Carolina, Chapel Hill (University of Maryland); and LEMUEL RICHARD RIGGINS, analysis, Ohio State University (Harvard University). -NSF

Ford Foundation Minority Fellowships

One hundred outstanding minority scholars have been awarded fellowships in the 1994 Ford Foundation fellowship programs. The programs, administered by the National Research Council (NRC), seek to increase the presence of underrepresented minority groups on the nation's college and university faculties.

Predocctoral fellowships provide funds for stipends and tuition for three years. Dissertation fellows receive stipends for nine or twelve months. The postdoctoral fellowships enable awardees to engage in postdoctoral research and scholarship in an environment free from the interference of their normal professional duties.

Among the fifty-five predocctoral fellows, three were in mathematics: FRANCES YVONNE JACKSON, California Institute of Technology; MARIA CRISTINA

VILLALOBOS, Rice University; and STEPHEN ALLEN WIRKUS, Cornell University. None of the twenty dissertation fellows or the twenty-five postdoctoral fellows was in mathematics.

-From NRC Press Release

Mathematician Appointed to White House Science Committee

Lilian Shiao-Yen Wu, a researcher at the IBM Thomas J. Watson Research Center, was named by President Clinton to the President's Committee of Advisors on Science and Technology. The White House press release noted that Wu's accomplishments include development of mathematical models and statistical methods for business forecasting and planning and the implementation of these methods in business practice. The Committee will be cochaired by Jack Gibbons, assistant to the president for science and technology, and John Young, former president and CEO of Hewlett-Packard.

-From Tidbits Electronic Newsletter

News from The Fields Institute for Research in Mathematical Sciences

The Fields Institute for Research in Mathematical Sciences is pleased to announce the appointment of John Chadam as president and scientific director. His appointment as president is for a two-year term commencing July 1, 1994.

John Chadam is a graduate of the MPC program at the University of Toronto and did his graduate work at the Massachusetts Institute of Technology, where he earned S.M. and Ph.D. degrees. Until 1985 he was at Indiana University-Bloomington with frequent leaves of absence at the Institute for Advanced Study in Princeton, Centre National de la Recherche Scientifique in Marseille, Institut des Hautes Études Scientifiques in Bures-sur-Yvette, and Centre des Recherches Mathématiques in Montreal. Since his return to Canada in 1985 he has been professor of mathematical sciences at McMaster University. He has served on many committees of the Natural Sciences and Engineering Research Council of Canada. He is a member of the international program committee

for the International Congress of Industrial and Applied Mathematics 1995. He has been involved throughout the developmental stage of the Fields Institute, serving on the Board of Directors and Scientific Advisory Panel and serving as program director for the Dynamical Systems Year, 1992–1993.

William F. Shadwick is continuing as the Institute's vice-president and executive director. He has accepted a joint professorship at the University of Toronto in the departments of Electrical and Computer Engineering and of Mathematics.

Operator Algebras and Applications is the main program for the 1994–1995 program year. In addition to regular meetings of seminars and graduate courses, the following workshops are planned: The Baum-Connes Conjectures (September 14–18, 1994); Dynamical Systems and C^* -Algebras (October 26–30, 1994); The Classification of Amenable C^* -Algebras (December 7–11, 1994); Operator Algebra Free Products and Random Matrices (March 8–12, 1995); Subfactors and their Applications (March 29–April 2, 1995); Low Dimensional Topology, Statistical Mechanics and Quantum Field Theory (April 26–30, 1995); and Quantum Groups and Their Connection with Quantized Functional Analysis (June 24–28, 1995). The twenty-third Canadian Annual Symposium on Operator Algebras will be held at the Fields Institute, May 28 – June 1, 1995.

The graduate courses for fall 1994 are: Structure and Classification of Amenable C^* -algebras, and Introduction to Operator Algebras. In addition, minicourses in Applications of Operator Theory will be held September 24–29, 1994.

The Fields Institute Distinguished Lecture Series will feature Dan Voiculescu, University of California, Berkeley (March 1995); Alain Connes, Collège de France (May 1995); Roger Penrose, University of Oxford (August 1995); and Vladimir Arnold, Steklov Institute, Moscow (June 1997).

For more information about Fields Institute programs, please contact: Sandra Valeriote, Executive Assistant, The Fields Institute for Research in Mathematical Sciences, 185 Columbia Street

West, Waterloo, Ontario, Canada, N2L 5Z5; telephone 519-725-0096; fax 519-725-0704; electronic mail valeriote@fields.uwaterloo.ca.

—From Fields Institute Announcement

**News from the
Mathematical Sciences Institute
Cornell University,
University of Puerto Rico,
and SUNY Stony Brook**

LFCS94 St. Petersburg, held July 11–14, was the third symposium in Logical Foundations of Computer Science in historic Russian cities. The first meeting was Botik89, the second Tver92. The general chair was Yu. V. Matiyasevich of the Steklov Institute in St. Petersburg, and the program chair was Cornell MSI Director A. Nerode. The conference was sponsored by the European Association of Theoretical Computer Science, the Steklov Institute of the Russian Academy of Sciences, the House of Scientists of St. Petersburg, the Russian Science Foundation, and MSI.

The Russian hosts, Yu. V. Matiyasevich and E. Ya. Dantsin, are particularly to be congratulated for successfully hosting a world-class conference at a politically unsettled moment in history in a city where the cost of living is rated 1.19 when New York City is rated 1 in a period when funds available for scientific meetings are minuscule. The organizers wish to thank the Western participants for registration fees, which were a major source for subsidizing many attendees from the former Eastern Bloc.

The plenary speakers were R. Gandy (University of Oxford), S. Artemov (Moscow State University and Steklov Institute, Moscow), J. Remmel (University of California at San Diego), V. Yu. Sazonov (Institute of Programming Systems, Pereslavl'skaya, Yaroslavl'skaya obl.), R. Shore (Cornell University), J.-Y. Girard (LMD Laboratoire de Mathématiques Discrètes, Marseille), M. Kanovich (Moscow State University), R. Parikh (Graduate Center, City University of New York), G. Makanin (Steklov Institute, St. Petersburg), M. Rabin (Hebrew University and Harvard University), G. Gottlob (Technical University of Vienna), Yu. Gurevich (University of Michigan), D. Rosenzweig (University

of Zagreb, Croatia), M. A. Taitlin (Tver University). The thirty-five contributed papers appear in Springer LNCS 813, *Logical Foundations of Computer Science* (Yu. A. Matiyasevich, A. Nerode, eds.), and a volume of invited papers (same editors) will appear in *Annals of Pure and Applied Logic* in 1995.

The next meeting will be in the summer of 1996 at a yet-to-be-chosen historic site. Those who wish to be put on the mailing list for announcements should e-mail W. Kone at MSI wvk1@msiadmin.cit.cornell.edu.

On October 28–30, 1994, MSI will sponsor a workshop on Hybrid Systems and Autonomous Control at Cornell University. The registration fee will be \$95 for nonstudents and \$40 for students. Registration packets may be obtained from: Valerie Kaine, Mathematical Sciences Institute, 409 College Avenue, Ithaca, NY 14850; telephone 607-255-8005; e-mail vdk1@cornell.edu. See the *Notices*, May/June 1994, page 479, for more details.

A. Nerode and V. Marek from the University of Kentucky are co-general chairs for the 1994 International Logic Programming Symposium to meet November 13–17, 1994, in Ithaca, New York. For further information contact V. Marek at ilps@msiadmin.cit.cornell.edu.

—From MSI Announcement

News from MSRI

During the 1994–1995 academic year, MSRI will sponsor two programs: a full-year program on Automorphic Forms, and a half-year program in Complex Dynamics and Hyperbolic Geometry during the period January to May 1995. Applications for General Memberships or Postdoctoral Fellowships for next year are due by November 30, 1994.

The following workshops will be held in conjunction with the two programs:

October 24–28: Spectral Theory of Automorphic Forms and Number Theory, organized by Jeffrey Hoffstein, Peter Sarnak, and Audrey Terras.

January 9–20: Introduction to Complex Dynamics and Hyperbolic Geometry, organized by Steve Kerckhoff.

January 23–28: Hyperbolic 3-Manifolds and Conformal Dynamics, organized by Steve Kerckhoff.

March 20–24: New Vistas in Automorphic Forms, organized by Daniel Bump, James Cogdell, Steve Kudla, and Dinakar Ramakrishnan.

May 15–20: Low Dimensional Holomorphic Dynamics, organized by Mikhail Lyubich and John Smillie.

In addition there will be a special event during November 30 to December 3, 1994: a conference on The Future of Mathematical Communication, organized by Joe Christy, John Gage, David Hoffman, Stewart Loken, Andrew Odlyzko, and Richard Palais. Some of the topics to be addressed are the following:

- The various forms of electronic journals and how they are distinct from preprint servers;
- Archiving, correcting and commenting on electronic documents;
- The role of professional societies, traditional publishers, and libraries in the transition to paperless journals;
- New contents (video and executable programs) in mathematical documents and logical links inside a document and between documents;
- Making authoring software easier to use for the creation of these new “papers”;
- Verification, authentication and copyright issues;
- \TeX , hypertext and Mosaic;
- Building bridges between researchers and elementary teachers and students; and
- Real-time mathematical collaboration over the Internet with voice, video and whiteboard.

If at all possible, key events of this conference will be broadcast over the Internet to sites able to receive the Mbone channel. Communications about the conference should be sent either by email to work1194@msri.org or by regular mail to: Future of Mathematical Communication Conference, Mathematical Sciences Research Institute, 1000 Centennial Drive #5070, Berkeley, CA 94720-5070.

In many ways, the future of mathematical communication is here. MSRI is building an archive of electronically-

available preprints, accessible through Mosaic, which allows you to click through pages of photos, images, data, and soon even video clips. From whatever type of computer you are using, once Mosaic is running, just enter our address, or url. It is <http://msri.org>. Look here for our latest schedule of events as well as archives of mathematical e-prints and other sources of mathematics-related information.

MSRI is also available using either the popular text-based browser called Gopher or the old UNIX standard, FTP. The command line to use is either [gopher msri.org](mailto:msri.org) or [ftp msri.org](ftp://msri.org), respectively. If using FTP, login as anonymous for your name and give your e-mail address as your password.

Some frequently-used requests are the following:

- For workshop information send e-mail to workshops@msri.org.
- To subscribe to one of our mailing lists (Conversations or Announcements) send e-mail to majordomo@msri.org with the message help.
- To get application information send e-mail to application-info@msri.org.
- To get an application form send e-mail to send-application@msri.org.
- For general inquiries send e-mail to inquiries@msri.org

We also welcome inquiries by regular mail: Mathematical Sciences Research Institute, 1000 Centennial Drive #5070, Berkeley, CA 94720-5070.

— From MSRI Announcement

Staff at the NSF's Division of Mathematical Sciences

Listed below are the program directors for the coming academic year in the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF). The electronic mail addresses on Bitnet are the same as on the Internet (given below), except that the Bitnet addresses use the extension @nsf instead of @nsf.gov.

Classical Analysis

John V. Ryff, Program Director
703-306-1879
jryff@nsf.gov

Modern Analysis

Kevin Clancey, Program Director
703-306-1887
Joe W. Jenkins, Adjunct Program Director
703-306-1870

Geometric Analysis

Kichoon Yang, Program Director
703-306-1881

Topology and Foundations

Ralph M. Krause, Program Director
703-306-1886
Carol Wood, Adjunct Program Director
703-306-1870

Algebra and Number Theory

Ann K. Boyle
703-306-1875
Andrew G. Earnest, Program Director
703-306-1876
Gary Cornell, Adjunct Program Director
703-306-1870

Applied Mathematics

Daljit Ahluwalia
703-306-1877
Deborah F. Lockhart, Program Director
703-306-1882
James C. Alexander, Adjunct Program Director
703-306-1870
John E. Lagnese, Adjunct Program Director
703-306-1870

Computational Mathematics

(including mathematical biology)
Michael Steuerwalt
703-306-1878

Statistics and Probability

Sallie Keller-McNulty, Program Director
703-306-1870
Stephen M. Samuels, Program Director
703-306-1884

Strategic Activities and Special Projects

Alvin I. Thaler, Program Director
703-306-1880

The administrative staff includes:

Division Director

Frederic Y. M. Wan
703-306-1870

Deputy Division Director

Bernard R. McDonald
703-306-1872

Administrative Officer

Tyczer Henson
703-306-1873

The permanent Division staff consists of Boyle, Krause, Lockhart, McDonald, Ryff, and Thaler. The visiting scientists who have joined the DMS staff this year are: Andrew J. Earnest, Southern Illinois University at Carbondale; Sallie Keller-McNulty, Kansas State University; Stephen M. Samuels, Purdue University; Carol Wood, Wesleyan University; and Kichoon Yang, Arkansas State University.

Many thanks to the following visiting scientists who have returned to their home institutions: Daniel J. Madden, James F. Glazebrook, Alan J. Izenman.

DMS staff may be reached via electronic mail. To form the address, use the first initial followed by the last name, with the extension @nsf.gov for Internet and @nsf for Bitnet. For example, the Internet address for John Ryff is jryff@nsf.gov.

The mailing address is: Division of Mathematical Sciences, National Science Foundation, Room 1025, 4201 Wilson Boulevard, Arlington, VA 22230.

—NSF

Mathematics Staff in NSF's Education Directorate

The Directorate for Education and Human Resources (EHR) of the National Science Foundation (NSF) sponsors a range of programs that support educational projects in mathematics, science, and engineering. Listed below are the names and telephone numbers of those EHR program officers whose field is in the mathematical sciences or mathematics education. These individuals can provide information about the programs they oversee, as well as information about other EHR programs of interest to mathematicians. (The electronic mail addresses given below are Internet addresses; for Bitnet addresses, substitute the extension @nsf for @nsf.gov.)

Division of Elementary, Secondary, and Informal Education

Margaret Cozzens, Division Director
mcozzens@nsf.gov
703-306-1620

Teacher Enhancement Program

Diane Spresser
dspresser@nsf.gov

Henry Kepner
hkepner@nsf.gov
703-306-1620

Instructional Materials Development Program

John (Spud) Bradley
jbradley@nsf.gov
Emma Owens
eowens@nsf.gov
703-306-1620

Young Scholars Program

Jim Boone
jboone@nsf.gov

Division of Research, Evaluation, and Dissemination

Research in Teaching and Learning Program

Richard Lesh
rlesh@nsf.gov
703-306-1650

Division of Undergraduate Education

Lee Zia
lzia@nsf.gov
James Lightbourne
jhlightb@nsf.gov
Tina Straley
tstraley@nsf.gov
Elizabeth Teles
eteles@nsf.gov
703-306-1670

Office of Systemic Initiatives

Paula Duckett
pduckett@nsf.gov
Madeleine Long
mlong@nsf.gov
Carolyn Mahoney
cmahoney@nsf.gov
703-306-1690

Office of the Assistant Director for EHR

Lida K. Barrett, Senior Associate for Planning, Coordination, and External Affairs
lbarrett@nsf.gov
703-306-1602

The community expresses its thanks for a job well done to outgoing visiting scientists Peter Braunfeld, University of Illinois at Urbana-Champaign; Eric Robinson, Ithaca College; Rudolfo Tamez, California State University, Los Angeles; William Haver, Virginia Commonwealth University; and Dorothy Strong, Chicago Public Schools.

A number of visiting scientists in mathematics and mathematics education have joined the EHR staff this year. They are: Jim Boone, Texas A&M University; John S. Bradley, AMS; Carolyn Mahoney, California State University at San Marcos; Diane Spresser, James Madison University; and Lee Zia, University of New Hampshire (to start January 1995).

The mailing address is:
Directorate for Education and Human Resources
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Except for proposals submitted to the Division of Undergraduate Education (DUE), proposals should be submitted to:

Proposal Processing Unit
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Proposals to DUE should be sent to the address listed in the program announcement, or contact the DUE program officers listed above for further information.

—NSF

Staff at DoD Agencies

Five agencies of the Department of Defense fund research in the mathematical sciences. The names, addresses, and telephone numbers of the pertinent staff members are listed below.

Air Force Office of Scientific Research

Directorate of Mathematics and Geosciences
AFOSR/NM
110 Duncan Avenue
Suite B115
Bolling AFB, DC 20332-0001
Fax: 202-404-7496
Charles J. Holland, Director
202-767-5025
holland@afosr.af.mil

Optimization and Discrete Mathematics

Neal D. Glassman
202-767-5026
glassman@afosr.af.mil

Physical Mathematics and Applied Analysis

Arje Nachman
202-767-4939
nachman@afosr.af.mil

Electromagnetics

Arje Nachman
202-767-4939
nachman@afosr.af.mil

Artificial Intelligence

Abraham Waksman
202-767-4964
waksman@charm.isi.edu

Signal Processing, Probability, and Statistics

Jon A. Sjogren
202-767-4940
sjogren@afosr.af.mil

Computational Mathematics

Marc Jacobs
202-767-5027
marc@stealth.afosr.af.mil

Software and Systems

David Luginbuhl
202-767-5028
luginbuh@afosr.af.mil

Dynamics and Control

Marc Jacobs
202-767-5027
marc@stealth.afosr.af.mil

Space Sciences

Henry Radoski
202-767-4964
radoski@afosr.af.mil

Atmospheric Sciences

James Kroll
202-767-5028
kroll@afosr.af.mil

Terrestrial Sciences

Stan Dickinson
202-767-4964
dickinso@afosr.af.mil

There has been some reorganization at AFOSR. What was formerly the Directorate of Mathematics and Computer Science merged with the Directorate of Geosciences, and the new organizational unit is the Directorate of Mathematics and Geosciences. As a result, three new programs, in Space Sciences, Atmospheric Sciences, and Terrestrial Sciences have been added. Because of the modeling and simulation needs of these areas, these programs do have a mathematical component.

Steve Suddarth, who was selected for an Air Force training assignment in Brazil, has left the AFOSR. His replacement is David Luginbuhl, who was previously at the Air Force Institute

of Technology at Wright-Patterson Air Force Base in Dayton, Ohio.

Army Research Office

Mathematical and Computer Sciences Division
P.O. Box 12211
Research Triangle Park, NC 27709-2211
math@aro-emh1.army.mil
Jagdish Chandra, Director

Applied Analysis and Physical Mathematics

Julian Wu
919-549-4332
jjwu@aro-emh1.army.mil

Software Systems and Artificial Intelligence

David Hislop
919-549-4255
hislop@aro-emh1.army.mil

Infrastructure, Support Programs for Army High Performance Computing Center

Bruce Henriksen
919-549-4324
bruce@aro-emh1.army.mil

Numerical Analysis, Scientific Computing, Optimization, and Symbolic Methods

Kenneth D. Clark
919-549-4256
clark@adm.csc.ncsu.edu

Probability and Statistics

Jagdish Chandra (acting)
919-549-4254
chandra@aro-emh1.army.mil

Systems and Control; Centers of Excellence

Jagdish Chandra
919-549-4254
chandra@aro-emh1.army.mil

There have been two recent retirements in the Mathematical and Computer Sciences Division at the ARO: Gerald Andersen and Francis Dressel. Andersen served as associate director and as the program director for Probability and Statistics, and Dressel was program director for Workshops, Army-wide Conferences, Tutorials, and Special Projects. Those two positions are vacant. Jagdish Chandra is temporarily overseeing the Probability and Statistics program, and the programs Dressel

oversaw are currently being handled by the rest of the division staff.

Advanced Research Projects Agency

Applied and Computational Mathematics Program
3701 North Fairfax Drive
Arlington, VA 22203-1714
Bertram Hui
703-696-2239

James Crowley, who served as Program Manager for the Applied and Computational Mathematics Program at ARPA until this summer, is now managing director of the Society for Industrial and Applied Mathematics. The program is being overseen by other ARPA staff until a permanent replacement is hired. Bertram Hui can answer general inquiries about the program.

National Security Agency

Mathematical Sciences Program
Attn: R51A
Ft. George G. Meade, MD 20755-6000
Charles Osgood, Director
301-688-0400
msp@titan1.math.umbc.edu

—DoD

DoE Mathematics Program

The Department of Energy (DoE) funds research in the mathematical sciences in a number of areas, particularly applied mathematics and areas connected with the High Performance Computing and Communications (HPCC) initiative. The names of the directors of the relevant programs are given below.

Applied Mathematics

Frederick A. Howes
301-903-3166
howes@er.doe.gov

Computer Science

Dan Hitchcock
301-903-6767
hitchcock@er.doe.gov

HPCC

Tom Kitchens
301-903-5152
kitchens@er.doe.gov

These programs are managed by the Office of Scientific Computing (telephone: 301-903-5800, fax: 301-903-7774). The mailing address is the Department of Energy, Office of Scientific

Computing, ER-30, GTN, Washington, DC 20585. —DoE

November and December Notices to Be Combined

Starting with the January 1995 issue, the *Notices* will have a new look, a new style, a new and more interesting menu of articles. The most important change will be in the content, which will emphasize high-quality expository accounts of current advances in mathematics. In addition, the “new” *Notices* will feature a four-color cover and eye-catching graphics to enhance visual enjoyment of the magazine.

In order to insure a smooth transition in production, the November 1994 and the December 1994 issues of the *Notices*

will be combined into a single issue.

For further information, see the article by Hugo Rossi in the March 1994 issue, page 307. —AMS

Errata

A number of errors occurred in the announcement about the awarding of the Ostrowski Prize to Miklós Laczkovich and Marina Ratner, which appeared in the July/August 1994 issue of the *Notices*. The description of the work of Laczkovich inadvertently neglected to note that his solution of a problem of Daróczy was joint work with Ray Redheffer. The announcement should also have mentioned that at the prize ceremony R. Counzelmann, a member of the board of the Ostrowski Foundation,

spoke about the life and work of Alexander Ostrowski. Finally, there were two misprints in the first paragraph of the explanation of Ratner’s work. The corrected sentences appear below.

Let D be a discrete subgroup of a Lie group G , and let H be the subgroup generated by G ’s unipotent elements. Further, let m be a finite measure on G/D , invariant and ergodic under the left action of H onto G/D .

The name of L. Ridgway Scott, a member of the *Notices* Editorial Committee, was inadvertently left off the masthead in the May/June, July/August, and September issues of the *Notices*. The *Notices* staff regrets the error.

PROCEEDINGS OF SYMPOSIA IN PURE MATHEMATICS

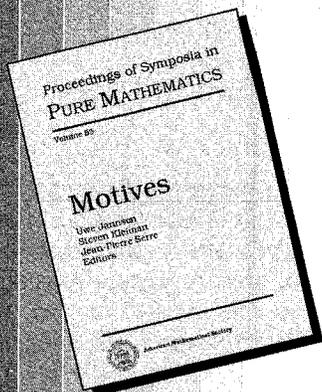
Motives

Uwe Jannsen, Steven Kleiman, and Jean-Pierre Serre, Editors
Volume 55

Motives were introduced in the mid-1960s by Grothendieck to explain the analogies among the various cohomology theories for algebraic varieties, to play the role of the missing rational cohomology, and to provide a blueprint for proving Weil’s conjectures about the zeta function of a variety over a finite field. Over the last ten years or so, researchers in various areas—Hodge theory, algebraic K -theory, polylogarithms, automorphic forms, L -functions, ℓ -adic representations, trigonometric sums, and algebraic cycles—have discovered that an enlarged (and in part conjectural) theory of “mixed” motives indicates and explains phenomena appearing in each area. These volumes contain the revised texts of nearly all the lectures presented at the AMS-IMS-SIAM Joint Summer Research Conference on Motives, held in Seattle in 1991. A number of related works are also included, making for a total of forty-seven papers, from general introductions to specialized surveys to research papers.

1991 *Mathematics Subject Classification*: 14; 11, 19
 ISBN (Set) 0-8218-1635-7, (Part 1) 0-8218-1636-5, (Part 2) 0-8218-1637-3
 1423 pages (Set), 747 pages (Part 1), 676 pages (Part 2), (hardcover),
 February 1994
 Set: List price \$250, Individual member \$150, Institutional member \$200
 Part 1: List price \$140, Individual member \$84, Institutional member \$112
 Part 2: List price \$129, Individual member \$77, Institutional member \$103
 To order, please specify PSPUM/55NA (Set), PSPUM/55.1NA (Part 1),
 PSPUM/55.2NA (Part 2)

All prices subject to change. Free shipment by surface: for air delivery, please add \$6.50 per title. *Prepayment required.* Order from: American Mathematical Society, P.O. Box 5904, Boston, MA 02206-5904, or call toll free 800-321-4AMS (321-4267) in the U.S. and Canada to charge with VISA or MasterCard. Residents of Canada, please include 7% GST.



Funding Information

for the Mathematical Sciences

AMS Centennial Fellowships Invitation for Applications, 1995–1996

Deadline: December 1, 1994

These fellowships are intended to provide enhanced research opportunities to mathematicians who are several years past the Ph.D., who have a strong research record, but who have not had extensive postdoctoral research support in the past. Applicants should have received the Ph.D. degree between January 1, 1983, and December 31, 1988, and should not have had the equivalent of more than two years of full-time postdoctoral support.

The stipend for fellowships awarded for 1995–1996 has been set by the Trustees of the Society at \$43,900 for nine months. In addition, there will be an expense allowance of \$1,435. Applicants must be citizens or permanent residents of a country in North America. The fellowship may be combined with other stipends and/or part-time teaching; this option can be used to extend the award to cover a period of up to two years. For further information about the acceptability of such arrangements, individuals should contact the secretary of the Society.

The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Trustees have arranged a matching program from general funds in such fashion that funds for at least one fellowship are guaranteed. Because of the generosity of the AMS membership, it has been possible to award two or three fellowships a year for the past seven years.

The deadline for receipt of applications is **December 1, 1994**. Awards will be announced in February 1995, or earlier if possible.

For application forms, write to the Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248 or electronic mail ams@math.ams.org.

–AMS

North American Research Fellowships

The North American Research Fellows Program is sponsored by the National Science Foundation (NSF), the Natural Sciences and Engineering Research Council of Canada (NSERC), and the National Council for Science and Technology of Mexico (CONACyT). The program will provide support for scientists and engineers from the U.S., Canada, or Mexico to visit research establishments in one or both of the other two countries for periods of three to twelve months.

The program is aimed primarily at applicants who are no more than ten years from the Ph.D. and whose research would benefit from the international exposure. The fellowships can also be used in conjunction with sabbatical leaves. Applications from women and minorities are especially encouraged.

The deadline for applications is **November 1, 1994**. U.S. citizens and permanent residents should contact: NSF, Division of International Programs, Room 935, 4201 Wilson Boulevard, Arlington, VA 22230-0935; telephone 703-306-1706; TDD 703-306-0090; e-mail sparris@nsf.gov.

Mexican citizens and permanent residents should contact: CONACyT, Dirección Adjunta de Asuntos Internacionales, Av. Constituyentes 1046, 3er. Piso, Col. Lomas Altas, C.P. 11950, México, D.F.; telephone (52-5)3-27-74-00, exts. 7570, 7211; electronic mail infor@dcoin.adm.conacyt.mx.

Canadian citizens and permanent residents should contact: NSERC, International Programs, 350 Albert Street, Ottawa, Canada K1A 1H5; telephone 613-995-1818; e-mail intl@nserc.ca.

–From NSF Announcement

Postdoctoral Associateships in Computing Fields

The Computer and Information Science and Engineering Directorate of the National Science Foundation plans a limited number of grants for postdoctoral associateships in computational science and engineering and in experimental science. Universities, colleges, and other research institutions are eligible to submit proposals to this program. Awards will be based on proposals submitted by sponsoring institutions.

The deadline for proposals is **November 1, 1994**. For information on the associateships in computational science and engineering, contact: New Technologies Program Director, Division of Advanced Scientific Computing, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; telephone 703-306-1970; e-mail ntpd@nsf.gov. For information on the associateships in experimental science, contact: Program Director, Cross-Disciplinary Activities, at the same address as above; telephone 703-306-1980; e-mail espd@nsf.gov.

–NSF

For Your Information

The First Annual Hudson River Undergraduate Mathematics Conference

Douglas R. Briggs

Douglas R. Briggs graduated in June 1994 from Williams College with a double major in mathematics and German. He has begun work toward a Ph.D. in computer science at the University of Illinois at Urbana-Champaign.

The second annual Hudson River Undergraduate Mathematics Conference will be held at Siena College, near Albany, New York, on April 8, 1995. Jean Taylor of Rutgers University will present the invited address. For information about the conference, contact the chair of the Steering Committee, Emelie Kenney, Department of Mathematics, Siena College, Loudonville, NY 12211-1462; electronic mail kenney@siena.bitnet.

On Saturday, April 9, 1994, the first annual Hudson River Undergraduate Mathematics Conference took place at Siena College in Loudonville, New York. Seventy presentations were scheduled, at least two-thirds of which were given by undergraduates. In addition to the twenty-one schools which brought presenters and authors to the conference (some of whom came from as far away as Bates College in Maine!), there were twenty-six other participating institutions. Over 270 students and faculty attended.

The day began at 9:00 with donuts, pastries, orange juice, coffee, and tea, followed by a session of three 15-minute presentations before Professor John H. Conway's address at 11:15. His keynote speech, which was pleasantly accessible to all levels of undergraduates, described a curious set of fourteen fractions which, when multiplied together according to a simple set of rules, yields the prime numbers in order as powers of 2 and furthermore comprises a computer "language" capable of calculating any computable function. Aside from his lecture, one of the most interesting aspects of Professor Conway's attendance was his openness to students—between sessions one could always find him in the conference foyer playing mathematical games such as Nim or explaining how to calculate the day of the week for any date in history using his "Doomsday Method". Two more hours of presentation sessions followed a generous lunch schedule, which was designed to allow time for speakers and participants to exchange ideas and discuss material from the presentations.

A light supper and a refreshing party followed the afternoon sessions and concluded the conference.

The design of the conference, the first of its kind, centered on presentation sessions, organized by topic and moderated by students and faculty. The presentations were of two kinds: those whose intended audience would be faculty and mathematics majors, and those which would be accessible to any undergraduate. Talks ranged in subject from coloring knots to an investigation of the mathematics behind Escher's artwork to an analysis of Fibonacci primes. The accessibility of the material, in concert with the format of the sessions, was designed to encourage students to present their work and indirectly to stimulate both more prevalent support of undergraduate research and other conferences geared specifically toward undergraduate participation. The situation was ideal for the undergraduate delegates in that there was no registration fee, meals were provided free of charge, and many of the schools arranged transportation.

Some of the most interesting aspects of the conference involved the open exchange of information. Students were encouraged to meet informally outside the sessions and discuss aspects of their work or other interesting mathematical topics, and the foyer was constantly full of students and faculty members discussing material from the presentations. Many electronic mail addresses were exchanged, and, for my own part, I met a faculty member from Saint Lawrence University who, after attending the presentation of my thesis results in graph theory, mentioned a number of interesting results which he knew from his work in Lie algebras.

The conference, which many (myself included) agreed was a resounding success, was organized by a steering committee consisting of Emelie Kenney, chair (Siena College), Frank Morgan (Williams College), David Vella (Skidmore College), and William Zwicker (Union College), as well as numerous local organizers. It was funded by grants from the Alfred P. Sloan Foundation and the National Science Foundation, and was also supported by the AMS, the American Statistical Association, the Association for Women in Mathematics, the Mathematical Association of America, the Operations Research Society of America, the Society for Industrial and Applied Mathematics, and Siena College. Next year the conference will also be at Siena College; in 1996 it will rotate to Skidmore College in Saratoga Springs, New York.

1994 AMS Election

Candidates

OFFICERS

Vice-President (one to be elected)

C. Herbert Clemens Joseph B. Keller
Gian-Carlo Rota (by petition)

Member-at-Large of the Council (five to be elected)

Georgia M. Benkart Benjamin A. Lotto (by
Carlos Castillo-Chavez petition)
David B. A. Epstein Jerrold E. Marsden
Cameron M. Gordon Cora Sadosky
James M. Hyman Alice Silverberg
Mark W. Winstead

Board of Trustees (one to be elected)

Frank C. Hoppensteadt Donald E. McClure

NOMINATING COMMITTEE FOR 1995

(Three to be elected)

Jerry L. Bona Rogers J. Newman
Ingrid Daubechies Stephen D. Smith
William James Lewis Susan G. Williams

EDITORIAL BOARDS COMMITTEE FOR 1995

(Two to be elected)

Robert J. Blattner Harold M. Stark
Rhonda J. Hughes Herbert S. Wilf

Election Information

The ballot for election of officers, members of the Council, and a trustee and ratification of an amendment to the bylaws is included in this issue of the *Notices* (and for members residing outside of North America in the election booklet). The deadline for receipt of a completed ballot is 10 November 1994. Members are urged to consult the following articles and sections of the Bylaws of the Society: Article I, Section 1; Article II, Sections 1,2; Article III, Section 1; Article IV, Sections 1, 2, 4; Article VII, Sections 1, 2, 5. The complete text of the Bylaws appears on pages 1266-1270 of November 1993, Volume 40, Number 9, issue of the *Notices*. A list of members of the Council and Board of Trustees serving terms during 1994 appears on page 856 in the AMS Reports and Communications section of the September issue of the *Notices* (and on a separate page in the special election booklet).

REPLACEMENT BALLOTS

There has been a small but recurring and distressing problem concerning members who state that they have not received ballots in the annual election. It occurs for several reasons, including failure of local delivery systems on university or corporate properties, failure of members to give timely notice of changes of address to the Providence office, failures of postal services, and other human errors.

To help alleviate this problem, the following replacement procedure has been devised: A member who has not received a ballot by October 10, 1994, or who has received a ballot but has accidentally spoiled it, may write after that date to the Secretary of the AMS, Post Office Box 6248, Providence, RI 02940, asking for a second ballot. The request should include the individual's member code and the address to which the replacement ballot should be sent. Immediately upon receipt of the request in the Providence office, a second ballot, which will be indistinguishable from the original, will be sent by first class or air mail. It must be returned in an inner envelope, which will be supplied, on the outside of which is the following statement to be signed by the member:

The ballot in this envelope is the only ballot that I am submitting in this election. I understand that if this statement is not correct then no ballot of mine will be counted.

signature

Although a second ballot will be supplied on request and will be sent by first class or air mail, the deadline for receipt of ballots will not be extended to accommodate these special cases.

SUGGESTIONS FOR 1995 NOMINATIONS

Each year the members of the Society are given the opportunity to propose for nomination the names of those individuals they deem both qualified and responsive to their views and needs as part of the mathematical community. Candidates will be nominated by the Council to fill positions on the Council and Board of Trustees to replace those whose terms expire January 31, 1996. See the **AMS Reports and Communications** section in the September issue of the *Notices* (pp. 856-868) for the list of current members of the Council and Board of Trustees. Members are requested to write their suggestions for such candidates in the appropriate spaces below.

SUGGESTIONS FOR 1995 NOMINATIONS

Council and Board of Trustees

Vice-President (1)

Members-at-large of the Council (5)

Member of the Board of Trustees (1)

The completed form should be addressed to AMS Nominating Committee, Post Office Box 6248, Providence, RI 02940, to arrive no later than **November 10, 1994**.

Oklahoma State University, Stillwater, Oklahoma

October 28–29, 1994

Preliminary Program

The eight hundred and ninety-fifth meeting of the American Mathematical Society will be held at Oklahoma State University in Stillwater, Oklahoma, on Friday, October 28, and Saturday, October 29, 1994. All sessions will be held in the OSU Student Union.

Invited Addresses

V. Lakshmibai, Northeastern University, *Combinatorics, geometry, and representation theory — an interplay.*

David E. Marker, University of Illinois at Chicago, *Model theory and exponentiation.*

David J. Wright, Oklahoma State University, *Counting number fields as orbits of representations.*

Joel Zinn, Texas A&M University, *On the Gaussian measure of the intersection of symmetric, convex sets.*

Special Sessions

New doctoral work in mathematics, **Efraim Armendariz**, University of Texas at Austin; **D. J. Lewis**, University of Michigan; **Andy R. Magid**, University of Oklahoma; and **Robert J. Zimmer**, University of Chicago.

Complex hyperbolic geometry and discrete groups, **Ara S. Basmajian** and **Robert R. Miner**, University of Oklahoma.

Representations of algebraic groups, **Edward T. Cline**, University of Oklahoma.

Number theory, **Brian Conrey**, Oklahoma State University, Stillwater, and **William D. Duke**, Rutgers University.

Algebraic geometry, **Bruce C. Crauder** and **Zhenbo Qin**, Oklahoma State University, Stillwater.

Geometry and representations of Lie groups, **Edward G. Dunne** and **Roger C. Zierau**, Oklahoma State University, Stillwater.

Fluid dynamics, **Alan R. Elcrat**, Wichita State University.

The evolving undergraduate mathematics curriculum, **Benny D. Evans**, Oklahoma State University, Stillwater.

Several complex variables, **Vladimir Ezhov** and **Alan V. Noell**, Oklahoma State University, Stillwater.

Technology in the classroom, **Jerry A. Johnson**, University of Nevada.

Arithmetic groups and topology, **Mark W. McConnell**, Oklahoma State University, Stillwater.

Geometry and geodesics, **Phillip E. Parker**, Wichita State University.

There also will be sessions of contributed ten-minute papers.

The deadline for submission of abstracts for all sessions has expired. Unfortunately, late papers cannot be accommodated.

The Special Session on *New doctoral work in mathematics* features doctoral students in Ph.D. programs in mathematics located in the Central Section of the AMS who expect to complete their degrees before the Fall semester of 1995 presenting talks on their doctoral work in progress. Participation is competitive and applications were required. All Central Section Ph.D. departments were invited to have their qualified students apply. Participants were selected on the basis of mathematical quality, diversity of subject area, and diversity of institutions.

Accommodations

Rooms have been blocked for participants at the Best Western, Holiday Inn, and Student Union hotels. Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the AMS meeting. **All rooms will be on a space-available basis after October 1, 1994.**

Holiday Inn (2 miles to OSU Student Union): West 6th Avenue, Stillwater, OK 74074. Telephone: 405-372-0800. Single, double, and triple rooms are \$45.00 (plus tax).

Best Western (0.5 miles to OSU Student Union): 600 East McElroy, Stillwater, OK 74074. Telephone: 405-377-7010. Single \$41.00 (plus tax); double, triple, and quadruple rooms are \$46.00 (plus tax).

Transportation between these hotels and the OSU campus will be available.

Student Union Hotel (located on campus): Student Union Building, Stillwater, OK. Telephone: 405-744-6835. Single, double, and triple rooms are \$42.00 (plus tax).

Food Service

Restaurants are located in the Best Western, Holiday Inn and Student Union Hotel. Many other restaurants are within walking distance of the university. A list will be available upon registration.

Other Activities

AMS representatives will be available at the meeting. Meeting participants can see demonstrations of MathSci Disc, the Society's mathematical reference database, and e-MATH, the AMS Internet connection. Participants can also discuss membership opportunities, examine new titles, and order most AMS books at a special 50% discount offered only at meetings.

Joint Books, Journals, and Promotional Materials Exhibit: This exhibit will be open the same hours as the registration desk and will provide participants with the opportunity to order publications and other materials from various commercial publishers not represented at the meeting.

Parking

Participants staying at the Student Union Hotel will find it most convenient to park in the Student Union parking garage. Parking for hotel guests is free. For participants staying elsewhere, on-campus parking is available in the Student Union parking garage for \$.65 per hour or a daily maximum of \$5.00.

On Thursday and Friday between the hours of 7:00 a.m. and 5:00 p.m., please note that parking in restricted areas will result in a parking ticket. After 5:00 p.m. on Thursday and Friday and all day on Saturday and Sunday, parking is open in most lots on campus.

Scheduled shuttle service will be available on all days.

Registration

The registration desk will be located inside the Student Union in the east wing and will be open from 7:00 a.m. to 7:00 p.m. on Friday, October 28, and Saturday, October 29. The registration fees are \$30 for members of the AMS; \$45 for nonmembers; and \$10 for emeritus members, students, or unemployed mathematicians.

Social Events

There will be a Cowboy Barbecue Dinner on Friday evening, October 28, 1994. The price will be \$15 per person. This is a ticketed event. Those interested in participating should contact Caroline Morris at 405-744-5688 or e-mail mcaroli@math.okstate.edu by **October 1**.

Travel

Delta has been selected as the official airline for this meeting. The following benefits are available exclusively to mathematicians and their families attending the meeting: a savings of up to 10% off any published domestic fare (includes U.S., Canada, Bermuda, the Bahamas, Puerto Rico, and the U.S. Virgin Islands), subject to applicable fare restrictions. Call 800-241-6760 between 8:00 a.m. and 11:00 p.m. EST to contact Delta directly or call any licensed travel agent. Instruct the ticket agent to refer to file **MO456** in order to qualify for the applicable discount.

Driving time from both the Tulsa International Airport and the Will Rogers World Airport is approximately 75 minutes. Shuttle service will be available from both airports. Car rental service is also available.

Shuttle service to and from both airports is available through the OSU Math Department. Cost is \$15/person one way. Arrangements must be made in advance by calling Suzy Walters at 405-744-5688 or e-mail wsuzann@math.okstate.edu.

For those arriving by car from Tulsa, follow the Cimarron Turnpike into Stillwater. Those coming from Oklahoma City should follow I-35, exit 174. In both cases, follow signs for Stillwater and Oklahoma State University.

Weather

Stillwater's average weather for late October is: average high 69°F, average low 48°F. The fall season is usually the most pleasant time of the year. Typically there is a high percentage of sunshine with an equally high chance of precipitation. Participants would be best advised to check the weather forecast immediately before travelling. However, the weather is very unpredictable, so participants should come prepared.



Presenters of Papers

Numbers following the names indicate the speakers' positions on the program.

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Program of the Sessions

The time limit for each contributed paper in the sessions is ten minutes. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

Abstracts of papers presented in the sessions at this meeting will be found in the October 1994 issue of *Abstracts of papers presented to the American Mathematical Society*, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (▶) may be of interest to undergraduate students.

Friday, October 28

Special Session on Geometry and Representations of Lie Groups, I

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Remarks on the Spohn representation.* Preliminary report.
(1) **Ray A. Kunze**, University of Georgia (895-22-168)
- 9:00 a.m. *Characteristic cycles associated to Schubert varieties.*
(2) **Brian D. Boe*** and **Joseph H. G. Fu**, University of Georgia (895-14-118)
- 9:30 a.m. *Character polynomials of discrete series representations of $U(p, q)$.* Preliminary report.
(3) **Mladen Bozicevic**, Oklahoma State University, Stillwater (895-22-71)
- 10:00 a.m. *Geometric multiplicity formulas.*
(4) **Sam Evens**, University of Arizona (895-22-106)
- 10:30 a.m. *Characteristic classes of principal bundles in algebraic geometry.*
(5) **Dan Edidin**, **William Graham*** and **Burt J. Totaro**, University of Chicago (895-22-132)

Special Session on New Doctoral Work in Mathematics, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Non-polynomial polar forms and spline functions.*
(6) **D. E. Gonsor**, Kent State University, Kent (895-41-150)
- 9:30 a.m. *Potential theory on Lipschitz domains and boundary control problems.*
(7) **Zhonghai Ding**, Texas A & M University, College Station (895-49-141)
- 10:00 a.m. *Parallel decomposition methods in coarse grained optimization.*
(8) **Golbon Zakeri**, University of Wisconsin, Madison (895-90-13)
- 10:30 a.m. *Description of the range of the exponential Radon transform.*
(9) **Valentina Aguilar**, Wichita State University (895-44-155)

Special Session on Complex Hyperbolic Geometry and Discrete Groups, I

9:00 a.m.–10:45 a.m.

- 9:00 a.m. *Discrete groups of complex hyperbolic isometries containing parabolic maps.*
(10) **John R. Parker**, University of Warwick, England (895-51-77)
- 10:00 a.m. *Algebraic methods in complex hyperbolic geometry.*
(11) **Hanna Sandler**, American University (895-51-193)

Special Session on Representations of Algebraic Groups, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Sheaves of differential operators on G/B and local cohomology functors.*
(12) **Thomas L. La Francoise**, University of Illinois, Urbana-Champaign (895-14-125)
- 9:30 a.m. *Localization for derived categories of (g, K) -modules.*
(13) **Valery Lunts*** and **J. Bernstein**, Indiana University, Bloomington (895-22-97)
- 10:00 a.m. *Modules over the Hecke algebra and the p -adic Kazhdan-Lusztig conjecture.*
(14) **Roy Joshua**, Ohio State University, Columbus (895-14-92)
- 10:30 a.m. *Harmonic polynomials and the cohomology of compact Lie groups.*
(15) **Mark S. Reeder**, University of Oklahoma (895-22-38)

Special Session on Algebraic Geometry, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Curves in a projective plane and symplectic packings.*
(16) **Geng Xu**, Johns Hopkins University, Baltimore (895-14-130)
- 9:30 a.m. *The connectedness of space curve invariants.*
(17) **Michele Cook**, University of California, Los Angeles (895-14-19)
- 10:00 a.m. *Theta functions for vector bundles.*
(18) **Loring W. Tu**, Tufts University (895-14-07)

Friday, October 28 (cont'd)

- 10:30 a.m. *Stability of holomorphic pairs and other augmented bundles over Riemann surfaces.*
(19) **Steven Bradlow**, University of Illinois, Urbana-Champaign (895-14-108)

Special Session on Technology in the Classroom, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *An advanced mathematics course using mathematica and TeX.*
▶ (20) **S. W. Graham**, Michigan Technological University (895-98-59)
- 9:30 a.m. *Calculus and mathematica in local and distance education.*
▶ (21) **Jerry Uhl, Jr.**, University of Illinois, Urbana-Champaign (895-98-56)
- 10:00 a.m. *Using MAPLE worksheets in business calculus.*
(22) **Duane M. Broline***, **William J. Slough** and **Peter G. Andrews**, Eastern Illinois University (895-98-62)
- 10:30 a.m. *Curvature from every angle.*
▶ (23) **Robert J. Lopez**, Rose-Hulman Institute of Technology (895-98-57)

Special Session on Several Complex Variables, I

9:30 a.m.–10:50 a.m.

- 9:30 a.m. *One parameter automorphism groups on \mathbb{C}^2 whose time one map is polynomial.*
(24) **Patrick R. Ahern*** and **Franc Forstneric**, University of Wisconsin, Madison (895-32-169)
- 10:00 a.m. *Pick formulas for multi-dimensional lattice polyhedra.*
(25) Preliminary report.
Ricardo L. Diaz* and **Sinai Robins**, University of Northern Colorado (895-32-174)
- 10:30 a.m. *Function theory of Gromov hyperbolic covering spaces.*
(26) **Finnur Larusson**, Purdue University, West Lafayette (895-32-20)

Invited Address

11:00 a.m.–11:50 a.m.

- (27) *Combinatorics, geometry, and representation theory - an interplay.*
V. Lakshmibai, Northeastern University (895-20-73)

Invited Address

1:30 p.m.–2:20 p.m.

- (28) *Model theory and exponentiation.*
David E. Marker, University of Illinois, Chicago (895-03-74)

Special Session on Number Theory, I

2:30 p.m.–5:20 p.m.

- 2:30 p.m. *Multiplicative independence for random integers.*
(29) **Carl Pomerance**, University of Georgia (895-11-189)
- 3:00 p.m. *Carmichael numbers with three prime factors.*
(30) **S. W. Graham**, Michigan Technological University (895-11-23)
- 3:30 p.m. *The Beurling-Selberg extremal functions for a ball in Euclidean space.*
(31) **Jeffrey J. Holt***, Michigan Technological University, and **Jeffrey D. Vaaler**, University of Texas, Austin (895-11-115)
- 4:00 p.m. *The Beurling-Selberg extremal functions for a ball in Euclidean space.*
(32) **Jeffrey J. Holt**, Michigan Technological University, and **Jeffrey D. Vaaler***, University of Texas, Austin (895-11-116)
- 4:30 p.m. *Breaking classical convexity in Waring's problem.*
(33) **Trevor D. Wooley**, University of Michigan, Ann Arbor (895-11-48)
- 5:00 p.m. *Mean-values of the Riemann zeta-function. II.*
(34) **K. Soundararajan**, University of Michigan, Ann Arbor (895-11-53)

Special Session on New Doctoral Work in Mathematics, II

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *The genus of curves on the three dimensional quadric.*
(35) **Mark Andrea Antonio De Cataldo**, University of Notre Dame (895-14-138)
- 3:30 p.m. *The geometry of fixed point varieties on affine flag manifolds.*
(36) **Daniel S. Sage**, University of Chicago (895-14-152)
- 4:00 p.m. *Unitary structures for positive spin ladder representations of $U(p, q)$.*
▶ (37) **John D. Lorch**, Oklahoma State University, Stillwater (895-22-85)
- 4:30 p.m. *A concrete realization of certain unitary representations of $Sp(n, \mathbb{R})$.* Preliminary report.
▶ (38) **Jodie D. Novak**, Oklahoma State University, Stillwater (895-22-109)
- 5:00 p.m. *Representations of the graded Hecke algebra associated to the root system of type $I\tilde{I}_3$.*
(39) **Catherine E. Krilloff**, University of Michigan, Ann Arbor (895-16-99)

Special Session on Complex Hyperbolic
Geometry and Discrete Groups, II

3:00 p.m.–5:45 p.m.

- 3:00 p.m. *Examples of complex hyperbolic surfaces homotopy equivalent to Riemann surfaces.* (40)
William Mark Goldman*, University of Maryland, College Park, **M. Kapovich**, University of Utah, and **Bernhard Leeb**, University of Bonn, Germany (895-53-145)
- 4:00 p.m. *Points of approximation of discrete subgroups of $U(1, n; C)$.* (41)
Shigeyasu Kamiya, Okayama University of Science, Japan (895-22-147)
- 5:00 p.m. *A partial differential equation characterization of certain complex hyperbolic manifolds.* Preliminary report. (42)
Robert Molzon and **Karen Pinney Mortensen***, University of Kentucky (895-53-163)

Special Session on Representations
of Algebraic Groups, II

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Small infinite dimensional modules.* (43)
Andy R. Magid, University of Oklahoma (895-20-79)
- 3:30 p.m. *Parabolic Kazhdan-Lusztig polynomials.* (44)
V. Deodhar, Indiana University, Bloomington (895-20-181)
- 4:00 p.m. *Tilting modules: Characters and tensor products.* Preliminary report. (45)
J. E. Humphreys, University of Massachusetts, Amherst (895-20-101)
- 4:30 p.m. *Big cell algebras and group representations.* (46)
Mohan S. Putcha, North Carolina State University (895-20-28)
- 5:00 p.m. *Restricted Verma module resolutions.* Preliminary report. (47)
Mary Lynn Reed, University of Illinois, Urbana-Champaign (895-22-102)

Special Session on Algebraic Geometry, II

3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Classification of Fano threefolds via Gaussian maps.* (48)
Rick Miranda, Colorado State University (895-14-08)
- 3:30 p.m. *On Fano manifolds with normal projective connections.* (49)
Yun-Gang Ye, University of Texas, Arlington (895-14-81)
- 4:00 p.m. *On compact Kähler manifolds with Nef tangent bundles.* (50)
Qi Zhang, University of Missouri, Columbia (895-14-04)
- 4:30 p.m. *Degeneration of Calabi-Yau manifold with Weil-Petersson metric.* (51)
Yoshiko Hayakawa, Oklahoma State University, Stillwater (895-14-68)

- 5:00 p.m. *Degree eleven manifolds of dimension ≥ 3 .* (52)
Preliminary report.
GianMario Besana*, Oklahoma State University, Stillwater, and **Aldo Biancofiore**, Università degli Studi di L'Aquila, Italy (895-14-35)
- 5:30 p.m. *2-Forms and pluricanonical maps.* (53)
T. Luo, University of Texas, Arlington (895-14-44)

Special Session on Geometry and
Representations of Lie Groups, II

3:00 p.m.–6:50 p.m.

- 3:00 p.m. *Intertwining operators into cohomology spaces.* Preliminary report. (54)
A. W. Knap, State University of New York, Stony Brook (895-22-46)
- 3:30 p.m. *On the unitary representations of $Sp(p, q)$ with regular infinitesimal character.* Preliminary report. (55)
Susana Alicia Salamanca-Riba, New Mexico State University, Las Cruces (895-22-107)
- 4:00 p.m. *Spherical Laplace transforms and inversion formulas.* (56)
Gestur Olafsson, Louisiana State University, Baton Rouge (895-43-90)
- 4:30 p.m. *A geometric criterion for Gelfand pairs associated with the Heisenberg group.* (57)
Chal Benson*, **Gail Ratcliff**, University of Missouri, St. Louis, **Joe Jenkins**, State University of New York, Albany, and **Ronald Lipsman**, University of Maryland, College Park (895-22-14)
- 5:00 p.m. *$L_\lambda(\mathfrak{g})$ and the rank two lie groups: Their construction, geometry, and character formulas.* (58)
Mark R. Sepanski, Massachusetts Institute of Technology (895-22-12)
- 5:30 p.m. *Generic representations of parabolic subgroups.* (59)
Alexander L. Dvorsky, University of California, Berkeley (895-43-87)
- 6:00 p.m. *Examples of Lie groups and algebras on an almost r -paracontact Riemannian manifold of P -Sasakian type.* (60)
A. Bucki, Oklahoma School of Science & Mathematics (895-53-34)
- 6:30 p.m. Informal Discussion

Special Session on Fluid Dynamics, I

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Singularity development in free-surface flows.* (61)
Gregory R. Baker, Ohio State University, Columbus (895-76-40)
- 3:30 p.m. *Thin films and degenerate diffusion equations.* (62)
Andrea L. Bertozzi*, University of Chicago, and **M. Pugh**, Courant Institute of Mathematical Sciences, New York University (895-76-172)
- 4:00 p.m. *Singularities at null points in ideal magnetohydrodynamics.* (63)
Isaac Klapper*, University of California Los Angeles, **Anita Rado** and **Michael Tabor**, University of Arizona (895-76-47)
- 4:30 p.m. *Cahn-Hilliard hydrodynamics.* Preliminary report. (64)
John Lowengrub, University of Minnesota, Minneapolis (895-76-176)

Friday, October 28 (cont'd)

- 5:00 p.m. *Narrow structure formation in Hele-Shaw flow.*
 (65) **Michael Siegel**, Ohio State University, Columbus
 (895-76-192)

Special Session on Several Complex Variables, II

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Capacities on compacta.* Preliminary report.
 (66) **Evgeny A. Poletsky**, Syracuse University
 (895-32-121)
- 3:30 p.m. *Symplectic structures and symmetries of solutions of complex Monge-Ampère equation.*
 (67) **Stanley Mamour Einstein-Matthews**, Oklahoma State University, Stillwater (895-35-179)
- 4:00 p.m. *Microlocal analytic and Gevrey regularity for d -bar- b and box- b .*
 (68) **David S. Tartakoff**, University of Illinois, Chicago
 (895-35-134)
- 4:30 p.m. *Minimality and perturbations of CR manifolds.*
 (69) **Charles A. Pehlivanian**, United States Military Academy (895-42-184)
- 5:00 p.m. *Peak functions on weakly pseudoconvex domains.*
 (70) **Jiye Yu**, Texas A & M University, College Station
 (895-32-42)

Special Session on Technology in the Classroom, II

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *GyroGraphics in calculus.*
 ▶ (71) **Jerry A. Johnson**, University of Nevada, Reno
 (895-98-61)
- 3:30 p.m. *Using MAPLE in differential equations.*
 (72) **Matthew P. Richey**, Saint Olaf College (895-98-58)
- 4:00 p.m. *Applied transformations and reflections with graphing calculators.*
 (73) **Samuel A. Lynch**, Southwest Missouri State University (895-98-65)
- 4:30 p.m. *The role of supercalculators in undergraduate mathematics.*
 ▶ (74) **Donald R. LaTorre**, Clemson University (895-98-63)
- 5:00 p.m. *Relationships between a function and its derivatives.*
 ▶ (75) **Gloria D. Donaldson**, Oklahoma School of Science and Mathematics (895-98-60)

Special Session on Arithmetic Groups and Topology, I

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Cohomological automorphic forms on $GL(4)$.*
 (76) Preliminary report.
Avner D. Ash*, Ohio State University, Columbus,
David Ginzburg, University of Tel Aviv, Israel, and
Mark McConnell, Oklahoma State University,
 Stillwater (895-11-50)
- 3:30 p.m. *Rigid analytic modular symbols.*
 (77) **Glenn Stevens**, Boston University (895-11-70)
- 4:00 p.m. *The topology of Hecke correspondences.*
 (78) **Paul E. Gunnells**, Massachusetts Institute of
 Technology (895-11-191)
- 4:30 p.m. *The mod- p cohomology of $GL(2p-2, \mathbb{Z})$.*
 (79) **Rajesh P. Manjrekar**, Ohio State University, Columbus
 (895-20-146)
- 5:00 p.m. *How not to construct all fibered knots and links?*
 (80) **Lee Rudolph**, Clark University (895-57-173)

Special Session on Geometry and Geodesics, I

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *The view from geodesics in naturally reductive spaces.*
 (81) Preliminary report.
Christopher T. J. Dodson*, University of Toronto, and
Lieven Vanhecke, Katholieke Universiteit Leuven,
 Belgium (895-53-11)
- 3:30 p.m. *Singularities and self intersections of curves evolving on surfaces.*
 (82) **Jeffrey A. Oaks**, University of Indianapolis
 (895-53-133)
- 4:00 p.m. Discussion
- 4:30 p.m. *Semi-Riemannian completeness.* Preliminary report.
 (83) **John Kelly Beem**, University of Missouri, Columbia
 (895-53-05)
- 5:00 p.m. *Composition operators between Bergman spaces on convex domains in \mathbb{C}^n .*
 (84) **Joseph A. Cima**, University of North Carolina, Chapel Hill, and **Peter R. Mercer***, Purdue University, West Lafayette (895-47-91)

Session on Groups, Rings, and Fields

3:00 p.m.–5:25 p.m.

- 3:00 p.m. *Waring's problem in number fields.* Preliminary report.
 (85) **Morley A. Davidson**, University of Michigan, Ann Arbor (895-11-45)
- 3:15 p.m. *Algorithmic p -descent in characteristic $p \geq 5$.*
 (86) **Antonios Broumas**, University of Texas, Austin
 (895-11-21)
- 3:30 p.m. *Rigidity of Tor for complete intersections.* Preliminary report.
 (87) **David Jorgensen**, University of Nebraska, Lincoln
 (895-13-32)

- 3:45 p.m. *Torsion in tensor products over one dimensional local domains.* Preliminary report.
(88) **Kurt Herzinger**, University of Nebraska, Lincoln (895-13-33)
- 4:00 p.m. *Theory of inertia and stability of matrices.* Preliminary report.
(89) **Wenchao Huang**, University of Wisconsin, Madison (895-15-158)
- 4:15 p.m. *Modules over nonsemisimple Artinian Frobenius algebras.*
(90) **Joseph Dolinak, II**, University of Wisconsin, Madison (895-20-15)
- 4:30 p.m. *Problems in block induction theorem.* Preliminary report.
(91) **Guoqiang Huang**, Northern Illinois University (895-20-160)
- 4:45 p.m. *Margulis lemma for real projective surfaces.*
(92) **Suhyoung Choi**, Kyungpook National University, Korea (895-57-166)
- 5:00 p.m. *Unitary representations and group actions.* Preliminary report.
(93) **Ralph Bremigan**, Ball State University (895-20-67)
- 5:15 p.m. *On the Bers fiber spaces.* Preliminary report.
(94) **Chaohui Zhang**, State University of New York, Stony Brook (895-32-17)

Saturday, October 29

Special Session on The Evolving Undergraduate Mathematics Curriculum, I

3:00 a.m.–5:50 p.m.

- 3:00 p.m. *Menger, derive and chapter 6 of Harvard calculus.*
(95) **Joseph Harkin**, Oklahoma State University, Stillwater (895-98-144)
- 3:30 p.m. *Linear algebra: Restructuring for a technology rich environment.*
(96) **Donald R. LaTorre**, Clemson University (895-15-148)
- 4:00 p.m. *Real and complex analysis: An amalgam for undergraduates.*
(97) **Anant P. Godbole**, Michigan Technological University (895-98-110)
- 4:30 p.m. *A mathematics minor for pre-service elementary teachers - making connections.*
(98) **Joel K. Haack*** and **Jack Wilkinson**, University of Northern Iowa (895-98-18)
- 5:00 p.m. *Mathematics across the curriculum.*
(99) **Jerry A. Johnson**, University of Nevada, Reno (895-98-113)
- 5:30 p.m. *Mathematics for the nontechnical: Why and What.*
(100) **Michael Starbird**, University of Texas, Austin (895-98-202)

Special Session on Algebraic Geometry, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Intersection lattices and the topological structures of complements of arrangements.*
(101) **T. Jiang**, Chicago State University, and **Stephen S.-T. Yau***, University of Illinois, Chicago (895-14-52)
- 8:30 a.m. *Set theoretic complete intersections in projective space.*
(102) **David B. Jaffe**, University of Nebraska, Lincoln (895-14-129)
- 9:00 a.m. *Refined residual intersections and some applications.*
(103) **Xian Wu**, University of South Carolina (895-14-27)
- 9:30 a.m. *Chow groups of singular varieties.*
(104) **Masaki Hanamura**, University of Chicago (895-14-96)
- 10:00 a.m. *Invariants of PGL_n and third cohomology.*
(105) **David Saltman**, University of Texas, Austin (895-14-123)
- 10:30 a.m. *Segre classes and graph colorings.*
(106) **Paolo Aluffi**, Florida State University (895-14-100)

Special Session on Geometry and Representations of Lie Groups, III

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Boundary value maps and unitarity.*
(107) **Leticia Barchini**, Temple University, Philadelphia (895-22-167)
- 8:30 a.m. *Geometric realizations for highest weight representations.*
(108) **Mark G. Davidson*** and **Raymond C. Fabec**, Louisiana State University, Baton Rouge (895-22-164)
- 9:00 a.m. *The oscillator character formula.*
(109) **Andrzej Daszkiewicz**, Nicholas Copernicus University, Poland, and **Tomasz Przebinda***, University of Oklahoma (895-22-84)
- 9:30 a.m. *Small subrepresentations of (degenerate) principal series.* Preliminary report.
(110) **Nolan R. Wallach**, University of California at San Diego, La Jolla (895-22-124)
- 10:00 a.m. *Whittaker models, nilpotent orbits and asymptotics of Harish-Chandra modules.*
(111) **David H. Collingwood**, University of Washington (895-22-104)
- 10:30 a.m. *The minimal representation for real exceptional Lie groups.*
(112) **Jing-Song Huang**, Hong Kong University of Science & Technology, Hong Kong (895-22-86)

Special Session on Arithmetic Groups and Topology, II

8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Cohomology of the symplectic group $SP(4, Z)$.*
(113) **Alan B. Brownstein**, Rutgers University, Newark, and **Ronnie Lee***, Yale University (895-22-126)
- 8:30 a.m. *Periodicity in the cohomology of $Out(F_n)$.*
(114) **Henry H. Glover**, Ohio State University, Columbus (895-35-200)

Saturday, October 29 (cont'd)

- 9:00 a.m. *On the non-existence of free actions of infinite groups on $R^k x(S^m)^l$.*
(115) **Chun-Nip Lee**, Northwestern University (895-57-16)
- 9:30 a.m. *Orlik-Solomon algebras and arithmetic groups.*
(116) **Alan B. Brownstein**, Monmouth Junction, New Jersey (895-11-186)
- 10:00 a.m. *Cohomological invariants of mapping class groups.* Preliminary report.
(117) **Stewart B. Priddy**, Northwestern University, and **Yining Xia***, Northern Illinois University (895-55-195)
- 10:30 a.m. *Differential operators for $SL(3, R)$.* Preliminary report.
(118) **Douglas Grenier***, University of Texas of the Permian Basin, and **Eric G. Stade**, University of Colorado, Boulder (895-11-171)

Special Session on New Doctoral Work in Mathematics, III

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *On Jentzsch's theorem.*
(119) **Xiaoling Qian**, University of Illinois, Urbana-Champaign (895-30-153)
- 9:00 a.m. *O-miminal homology.*
(120) **Arthur A. Woerheide**, University of Illinois, Urbana-Champaign (895-03-137)
- 9:30 a.m. *Dynamics of piecewise isometries.*
(121) **Arek Jozef Goetz**, University of Illinois, Chicago (895-53-136)
- 10:00 a.m. *Semigroups for which every right congruence is essential.*
(122) **Rekha Bai**, University of Iowa (895-20-154)
- 10:30 a.m. *Automorphism groups of combinatorial structures.*
▶ (123) **Robert Jajcay**, University of Nebraska, Lincoln (895-93-43)

Special Session on Representations of Algebraic Groups, III

8:30 a.m.–10:30 a.m.

- 8:30 a.m. *Resolutions and parabolic Schur algebras.*
(124) **Mihalis Maliakas**, University of Arkansas, Fayetteville (895-20-31)
- 9:00 a.m. *Infinitesimal Schur algebras.*
(125) **S. R. Doty**, Loyola University of Chicago (895-20-180)
- 9:30 a.m. *Complexity for infinitesimal Schur algebras.* Preliminary report.
(126) **Daniel K. Nakano***, Northwestern University, **S. R. Doty** and **Karl M. Peters**, Loyola University of Chicago (895-20-37)
- 10:00 a.m. *Exact Borel subalgebras.*
(127) **Brian Parshall***, University of Virginia, and **Jian Pan Wang**, East China Normal University, People's Republic of China (895-16-165)

- 10:30 a.m. *The units subgroup of a restricted envelope.*
(128) **William J. Haboush**, University of Illinois, Urbana-Champaign (895-20-156)

Special Session on Number Theory, II

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Sums of squares over function fields and spectral theory.*
(129) **Lynne H. Walling***, University of Colorado, Boulder, and **Kathy D. Merrill**, Colorado College (895-11-135)
- 9:00 a.m. *Fourth spectral moments of cusp forms.*
(130) **Nigel J. Pitt**, University of Michigan, Ann Arbor (895-11-190)
- 9:30 a.m. *On sums of consecutive squares.*
(131) **Andrew Bremner*** and **Eileen Wolfley**, Arizona State University (895-11-117)
- 10:00 a.m. *Mellin transforms of Whittaker functions.*
(132) **Eric G. Stade**, University of Colorado, Boulder (895-11-188)
- 10:30 a.m. *Average values of cubic L-series.* Preliminary report.
(133) **Daniel Lieman**, Columbia University (895-11-162)

Special Session on Several Complex Variables, III

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *On exhaustion of domains.*
(134) **Buma Fridman*** and **Daowei Ma**, Wichita State University (895-32-25)
- 9:00 a.m. *Boundary limits of the Bergman kernel and metric.*
(135) **Harold P. Boas**, **Emil J. Straube*** and **Jiye Yu**, Texas A & M University, College Station (895-32-185)
- 9:30 a.m. *Analysis on the Wu metric 1: The case of the Tullen domains.*
(136) **Chi-Keung Cheung***, Boston College, and **Kang-Tae Kim**, Brown University (895-32-122)
- 10:00 a.m. *More on zeroes of the Bergman kernel.*
(137) **Harold P. Boas**, Texas A & M University, College Station (895-32-183)
- 10:30 a.m. *CR singular surfaces.* Preliminary report.
(138) **Gary A. Harris**, Texas Tech University (895-32-119)

Special Session on Complex Hyperbolic Geometry and Discrete Groups, III

9:00 a.m.–10:45 a.m.

- 9:00 a.m. *Global rigidity of manifolds with symmetry.*
(139) **Yoshinobu Kamishima**, Kumamoto University, Japan (895-57-51)
- 10:00 a.m. *Invariant differential operators for projective geometry.*
(140) **Robert Molzon*** and **Hiroataka Tamanoi**, University of Kentucky (895-32-128)

Special Session on Fluid Dynamics, II

9:00 a.m.–10:20 a.m.

- 9:00 a.m. *Statistical equilibria and coherent structures in magnetohydrodynamics.* (141) **Richard Jordan**, Carnegie Mellon University (895-76-161)
- 9:30 a.m. *Bypass transition to turbulence - the role of linear and nonlinear mechanisms.* (142) **Peter Schmid**, University of Washington (895-76-26)
- 10:00 a.m. *Corner vortices in two dimensional hydrodynamics.* (143) **Kenneth G. Miller**, Wichita State University (895-76-94)

Special Session on Technology in the Classroom, III

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Using interactive MINITAB lessons to enhance the teaching of statistics.* (144) **John C. Longnecker**, University of Northern Iowa (895-98-64)
- 9:30 a.m. *X(PLORING) undergraduate mathematics.* (145) **Daniel C. Kemp**, South Dakota State University (895-98-66)
- 10:00 a.m. *Pictorial matrix ill-conditioning using MATLAB.* (146) **Martin Rooney**, University of Central Oklahoma (895-98-55)
- 10:30 a.m. *DERIVE and differential equations.* (147) **Benny Evans**, Oklahoma State University, Stillwater (895-98-54)

Special Session on Geometry and Geodesics, II

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *A Riemannian invariant and its applications to submanifold theory.* (148) **Bang-Yen Chen**, Michigan State University (895-53-78)
- 9:30 a.m. *Spi from Scri. Preliminary report.* (149) **Adam Helfer**, University of Missouri, Columbia (895-83-178)
- 10:00 a.m. *Pseudoconvex and disprisoning homogeneous sprays.* (150) **Lilia Del Riego***, University Autonoma de San Luis Potos, Mexico, and **Phillip E. Parker**, Wichita State University (895-53-177)
- 10:30 a.m. *Gravitational fields as two-dimensional geodesics.* (151) **Hernando Quevedo**, University National Autonoma de Mexico, Mexico (895-53-197)

Session on Analysis and Applied Mathematics

9:00 a.m.–10:40 a.m.

- 9:00 a.m. *The large eigenvalues of layered media.* (152) **Gerassimos A. Athanassoulis**, National Technical University of Athens, Greece, and **Vassilis G. Papanicolaou***, Wichita State University (895-35-03)

- 9:15 a.m. *Quantum field theory and relativistic computation over the continuum.* (153) **A. C. Manoharan*** and **M. Manoharan**, University of Central Oklahoma (895-32-36)
- 9:30 a.m. *Some mathematical problems of tomography and radiotherapy.* (154) **Serguei V. Lissianoï**, Wichita State University (895-44-157)
- 9:45 a.m. *Steepest descent and nonlinearly constrained energy-minimizing maps.* (155) **Javier Garza**, Tarleton State University (895-49-69)
- 10:00 a.m. *Abstract of the relativistic fluid dynamics.* (156) **Jing Chen**, University of Michigan, Ann Arbor (895-76-01)
- 10:15 a.m. *Regularity results for the solutions of the primitive equations of the atmosphere and the ocean.* (157) **Mohammed B. Ziane**, Indiana University, Bloomington (895-86-143)
- 10:30 a.m. *Two constant theorems for Hardy spaces in several variables.* (158) **John T. Anderson***, College of the Holy Cross, and **Joseph A. Cima**, University of North Carolina, Chapel Hill (895-32-39)

Invited Address

11:00 a.m.–11:50 a.m.

- (159) *On the Gaussian measure of the intersection of symmetric convex sets.* **Gideon Schechtman**, Weizmann Institute of Science, Israel, **Thomas Schlumprecht** and **Joel Zinn***, Texas A & M University, College Station (895-60-76)

Invited Address

1:30 p.m.–2:20 p.m.

- (160) *Counting number fields as orbits of representations.* **David J. Wright**, Oklahoma State University, Stillwater (895-11-75)

Special Session on Number Theory, III

2:30 p.m.–5:50 p.m.

- 2:30 p.m. *Galois theory, elliptic curves, and root numbers.* (161) Preliminary report. **David Rohrlich**, Boston University (895-11-105)
- 3:00 p.m. *Split primes of small norm.* (162) **John B. Friedlander**, University of Toronto (895-11-93)
- 3:30 p.m. *Converse theorems without twisting.* (163) **Brian Conrey**, Oklahoma State University, Stillwater, and **David Farmer***, Mathematical Sciences Research Institute, Berkeley (895-11-187)
- 4:00 p.m. *The Kubota symbol for $Sp(2n, Q(\sqrt{-m}))$.* (164) **Ozlem Erverdi Imamoglu**, University of California, Santa Barbara (895-11-120)
- 4:30 p.m. *Sums of multiplicative functions on shifted primes.* (165) **P.D.T.A. Elliott**, University of Colorado, Boulder (895-11-196)

Saturday, October 29 (cont'd)

- 5:00 p.m. *Zeros of Fekete polynomials.*
(166) **Brian Conrey**, Oklahoma State University, Stillwater,
Andrew J. Granville*, University of Georgia, and
Bjorn Poonen, AT&T Bell Laboratories, Murray Hill,
New Jersey (895-11-198)
- 5:30 p.m. *An application of combinatorics.*
(167) **Ilan Vardi**, Stanford University (895-11-199)

Special Session on New Doctoral Work in Mathematics, IV

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Diophantine approximation with prime numbers.*
(168) **Kwok-Kwong Choi**, University of Texas, Austin
(895-11-139)
- 3:30 p.m. *L-theory of crystallographic groups.*
(169) **Kimberly L. Pearson**, Indiana University, Bloomington
(895-19-140)
- 4:00 p.m. *Equations with Mathieu groups as their Galois groups
in characteristic 3.*
(170) **Ikkwon Yie**, Purdue University, West Lafayette
(895-12-151)
- 4:30 p.m. *Prime enveloping algebras.*
(171) **Mark Curtis Wilson**, University of Wisconsin, Madison
(895-16-09)
- 5:00 p.m. *Difference set: Its multiplier and existence.*
(172) **Qing Xiang**, Ohio State University, Columbus
(895-05-142)

Special Session on Complex Hyperbolic Geometry and Discrete Groups, IV

3:00 p.m.–5:45 p.m.

- 3:00 p.m. *Quasi-isometries between complex hyperbolic lattices.*
(173) **Richard Schwartz**, University of California at San
Diego, La Jolla (895-81-149)
- 4:00 p.m. *Stratification of the deformations of the complex
structures on complex hyperbolic surfaces.*
▶ (174) **Shigeru Takamura**, University of Maryland, College
Park (895-53-82)
- 5:00 p.m. *Triangle group actions on hyperbolic 4-manifolds.*
(175) **Peter L. Waterman***, Northern Illinois University, and
Nicolaas H. Kuiper, Institut des Hautes Etudes
Scientifiques, France (895-30-80)

Special Session on Representations of Algebraic Groups, IV

3:00 p.m.–4:50 p.m.

- 3:00 p.m. *Bases for Demazure modules.*
(176) **V. Lakshmibai**, Northeastern University (895-20-89)

- 3:30 p.m. *Actions on the Lakshmibai-Seshadri bases in the
minuscule cases.*
(177) **Robert A. Proctor**, University of North Carolina,
Chapel Hill (895-17-95)
- 4:00 p.m. *Shapovalov determinant for restricted and quantized
restricted enveloping algebras.*
(178) **Shrawan Kumar**, University of North Carolina, Chapel
Hill, and **Gail R. Letzter***, Massachusetts Institute of
Technology (895-17-111)
- 4:30 p.m. *Freeness of the quantum coordinate algebras.*
(179) **Zongzhu Lin**, Kansas State University (895-17-83)

Special Session on Algebraic Geometry, IV

3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Generators and resolutions of ideals defining certain
surfaces in projective space.*
(180) **Sandeep H. Holay**, University of Nebraska, Lincoln
(895-14-72)
- 3:30 p.m. *Torsion sections of elliptic surfaces.*
(181) **Rick Miranda**, Colorado State University, and **Peter F.
Stiller***, Texas A & M University, College Station
(895-14-29)
- 4:00 p.m. *Resolutions for fat points in the plane.*
(182) **Brian Harbourne**, University of Nebraska, Lincoln
(895-14-103)
- 4:30 p.m. *Examples of liftings of surfaces and a problem in de
Rham cohomology.*
(183) **William E. Lang**, Brigham Young University
(895-14-30)
- 5:00 p.m. *Equivalence and finite determinacy of mappings.*
(184) **Steven Dale Cutkosky*** and **Hema Srinivasan**,
University of Missouri, Columbia (895-14-06)
- 5:30 p.m. Informal Discussion

Special Session on Geometry and Representations of Lie Groups, IV

3:00 p.m.–6:20 p.m.

- 3:00 p.m. *Some Bott-Borel-Weil results for unitary highest weight
modules. Preliminary report.*
(185) **Ronald J. Stanke**, Baylor University (895-22-98)
- 3:30 p.m. *Embeddings of unitary highest weight representations.
Preliminary report.*
(186) **Thomas J. Enright**, University of California at San
Diego, La Jolla (895-22-131)
- 4:00 p.m. *Jordan algebras and small unitary representations.*
(187) **Siddhartha Sahi**, Rutgers University, New Brunswick
(895-22-22)
- 4:30 p.m. *Model algebras and nilpotent orbits in semisimple Lie
algebras.*
(188) **William McGovern**, University of Washington
(895-17-10)
- 5:00 p.m. *Representations of semisimple Lie groups with infinite
center.*
(189) **Robert D. Shalla**, University of Utah (895-22-88)
- 5:30 p.m. *Representations of the graded Hecke algebra
associated to the root system of type H_3 .*
(190) **Catherine E. Krilloff**, University of Michigan, Ann
Arbor (895-16-201)
- 6:00 p.m. Informal Discussion

Program of the Sessions

Special Session on Fluid Dynamics, III

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Resonant triads of capillary-gravity waves in the presence of a wind-drift current.*
(191) **Lawrence Christopher Morland**, Southern Methodist University (895-76-49)
- 3:30 p.m. *Spatial bifurcations of water and interfacial waves.*
(192) **Frederic Dias**, Institute Nonlineaire de Nice, France (895-76-112)
- 4:00 p.m. *Slip over rough and coated surfaces.*
(193) **Michael J. Miksis*** and **Stephen H. Davis**, Northwestern University (895-76-24)
- 4:30 p.m. Informal Discussions

Special Session on Several Complex Variables, IV

3:00 p.m.–4:20 p.m.

- 3:00 p.m. *Embedding three dimensional CR manifolds.*
(194) **John S. Bland***, University of Toronto, and **Charles L. Epstein**, University of Pennsylvania (895-32-159)
- 3:30 p.m. *Integrable analytic vector fields with a nilpotent linear part.*
(195) **Xianghong Gong**, University of Chicago (895-32-182)
- 4:00 p.m. *Automorphisms of CR quadrics, automorphisms of nondegenerate CR quadrics and Siegel domains. Explicit description.*
(196) **Vladimir V. Ezov**, Oklahoma State University, Stillwater (895-32-114)

Special Session on Geometry and Geodesics, III

3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Closed geodesics in 2-step nilmanifolds.*
(197) **Maura B. Mast**, Northeastern University (895-53-170)
- 3:30 p.m. *Geodesics in pseudoriemannian 2-step nilpotent Lie groups.* Preliminary report.
(198) **Luis A. Cordero**, University of Santiago, Spain, and **Phillip E. Parker***, Wichita State University (895-53-175)
- 4:00 p.m. Discussion
- 4:30 p.m. *Every Riemann surface has a half ray at each cusp.*
(199) **Mark Sheingorn***, Bernard M. Baruch College, City University of New York, and **Thomas A. Schmidt**, Oregon State University (895-30-02)
- 5:00 p.m. *Reflected geodesics.*
(200) **Thomas A. Schmidt***, Oregon State University, and **Mark Sheingorn**, Bernard M. Baruch College, City University of New York (895-30-127)

Andy R. Magid
Associate Secretary
Norman, Oklahoma

University of Richmond, Richmond, Virginia

November 11–13, 1994

Preliminary Program

The eight hundred and ninety-sixth meeting of the American Mathematical Society will be held at the University of Richmond, in Richmond, Virginia, on Friday, November 11; Saturday, November 12; and Sunday, November 13, 1994. Sessions will be held in Tyler Haynes Commons and Jepson Hall.

Invited Addresses

Loren D. Pitt, University of Virginia, *Probabilistic studies of nondifferentiable functions.*

Cora S. Sadosky, Howard University, *Lifting weights for fun and profit.*

Doron Zeilberger, Temple University, '='.

Special Sessions

Interpolation and dilation theory, **Joseph A. Ball**, Virginia Polytechnic University, and **Cora S. Sadosky**.

Set theoretic topology and set theory, **Amer Beslagic**, George Mason University.

Operators on Banach spaces of analytic functions, **Paul S. Bourdon**, Washington and Lee University, and **William T. Ross**, University of Richmond.

Groups, rings, and forms, **Douglas L. Costa** and **Gordon E. Keller**, University of Virginia.

Codes and designs, **James A. Davis**, University of Richmond, and **Harold N. Ward**, University of Virginia.

Quantum mechanics, **Ira W. Herbst**, University of Virginia.

Nonassociative algebras, **Teresa Magnus**, St. Mary's College.

Stochastic processes, **John P. Nolan**, American University.

Identities and enumeration, **Rodica E. Simion**, George Washington University, and **Doron Zeilberger**.

The deadline for submission of abstracts to be considered for any of these sessions has expired.

There will also be sessions for contributed ten-minute papers. This deadline has also expired.

Accommodations

Rooms have been blocked for participants at the following hotels. Participants should make their own arrangements directly with the hotel of their choice and request the AMS meeting rate to obtain the rate listed. **All rooms will be on a space-available basis. The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.** The hotels are not close to campus, so private transportation to and from campus will be necessary.

Comfort Inn: 7201 West Broad Street, Richmond, VA 23294. Telephone: 804-672-1108. Single or double is \$45. **Deadline for reservations is October 27, 1994.**

Ramada Inn West: 1500 East Ridge Road, Richmond, VA 23229. Telephone: 804-285-9061. Rooms are \$44 for single and \$48 for double. **Deadline for reservations is September 10, 1994.**

Other Activities

AMS representatives will be available at the meeting. Meeting Participants can see demonstrations of MathSci Disc, the Society's mathematical reference database, and e-MATH, the AMS Internet connection. Participants can also discuss membership opportunities, examine new titles, and order most AMS books at a special 50% discount offered only at meetings.

Joint Books, Journals, and Promotional Materials Exhibit: This exhibit will be open the same hours as the registration desk and will provide participants with the opportunity to order publications and other materials from various commercial publishers not represented at the meeting.

Parking

Parking for participants on Friday will be available in the student lots located off of Gateway Road. On the weekend most of the campus parking lots should be available.

Registration

The registration desk will be located in Room 201 of the Tyler Haynes Commons and will be open from 7:00 a.m. to 5:00 p.m. on Friday, November 11, and Saturday, November 12, and from 7:00 a.m. to noon on Sunday, November 13. The registration fees are \$30 for members of the AMS; \$45 for nonmembers; and \$10 for emeritus members, students, or unemployed mathematicians.

Social Events

The mathematics department will host a reception on campus, Saturday, November 12, at 8:00 p.m. Look for further information about this at registration.

Travel

USAir is the official airline for this meeting. The following benefits are available exclusively to mathematicians and their families attending the meeting: 10% discount off any published domestic fare with a seven-day advance purchase.

Meetings

Participants wishing to take advantage of these reduced fares should call USAir's Meetings and Convention Reservation Office at 800-334-8644 between 8:00 a.m. and 9:00 p.m. EST or any licensed travel agent. Instruct the agent to refer to gold file #16950015 in order to qualify for the applicable discount.

For those arriving by car, to reach the university from the:

West: I-64, take exit 183/Glenside Drive south, turn left on Three Chopt Road; U.S. 250 (Broad Street Road), turn right on Glenside Drive south, left on Three Chopt Road; U.S. 60 (Midlothian Turnpike), left on State Route 147 (Huguenot Road), continue to Three Chopt Road, turn left.

Southwest: U.S. 360 (Hull Street Road), left on State Route 653 (Courthouse Road), it will become State Route 147 (Huguenot Road), continue to Three Chopt Road, turn left.

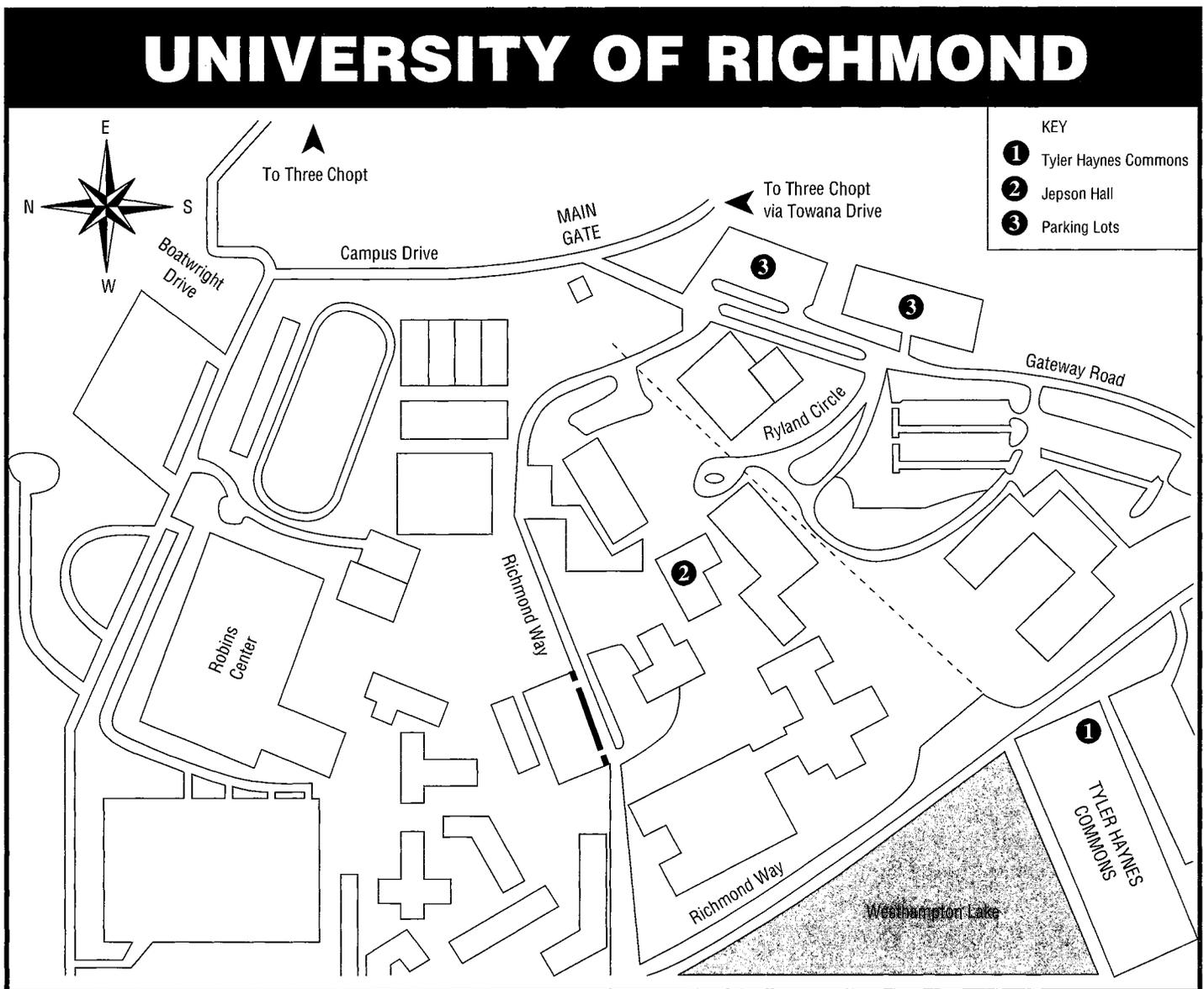
North: I-95, U.S. 1, U.S. 301 (Do not take I-295), take exit 79 to I-64 west, take exit 183-A/Glenside Drive south, continue to Three Chopt Road, turn left.

East: I-64, U.S. 60, west on I-64, take exit 183-A/Glenside Drive south, continue to Three Chopt Road, turn left.

South: I-85 to I-95, take exit 67/State Route 150 (Chippenham Parkway), right on State Route 147 (Huguenot Road), continue to Three Chopt Road, turn left; U.S. 1, west on I-64, take exit 183-A/Glenside Drive south, continue to Three Chopt Road, turn left.

Weather

The weather during the month of November is generally cool. The average temperature ranges from a high of 52°F during the day to a low of 35°F during the night. It is best to be prepared for varying temperatures.



Program of the Sessions

The time limit for each contributed paper in the sessions is ten minutes. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

Abstracts of papers presented in the sessions at this meeting will be found in the October 1994 issue of *Abstracts of papers presented to the American Mathematical Society*, ordered according to the numbers in parentheses following the listings below.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (\blacktriangleright) may be of interest to undergraduate students.

Friday, November 11

Invited Address

1:25 p.m.–2:15 p.m.

- (1) *Probabilistic studies of non-differentiable functions.*
Loren D. Pitt, University of Virginia (896-60-09)

Special Session on Interpolation and Dilation Theory, I

2:30 p.m.–4:50 p.m.

- 2:30 p.m. *Zero-pole matrix function interpolation on Riemann surfaces.*
(2) **Kevin F. Clancey**, University of Georgia (896-47-115)
- 3:00 p.m. *Zero-pole interpolation for meromorphic matrix functions on an algebraic curve with determinantal representation.*
(3) **Joseph A. Ball***, Virginia Polytechnic Institute and State University, and **Victor Vinnikov**, Weizmann Institute of Science, Israel (896-14-07)
- 3:30 p.m. *Pure subjordan operators and simultaneous approximation by a polynomial and its derivative.*
(4) **Joseph A. Ball**, Virginia Polytechnic Institute and State University, and **Thomas R. Faney***, Virginia Wesleyan College (896-47-06)
- 4:00 p.m. *Symmetric factorizations of symmetric rational matrix functions.*
(5) **Leiba Rodman**, College of William and Mary (896-15-72)
- 4:30 p.m. *Semi-Fredholmness of Toeplitz operators with (semi) almost periodic matrix symbols.*
(6) **Yu I. Karlovich**, Ukrainian Academy of Sciences, Ukraine, and **I. Spitkovsky***, College of William and Mary (896-47-69)

Special Session on Set Theoretic Topology and Set Theory, I

2:30 p.m.–5:20 p.m.

- 2:30 p.m. *Split compactification and realcompact extensions.*
(7) Preliminary report.
Charles Aull, Virginia Polytech Institute & State University (896-54-141)
- 3:00 p.m. *Irreducible collections of open sets in product spaces.*
(8) **L. Brian Lawrence**, George Mason University (896-54-146)
- 3:30 p.m. *Topological and algebraic copies of \mathbf{N}^* in \mathbf{N}^* .*
(9) **Neil B. Hindman***, Howard University, and **Dona Strauss**, University of Hull, England (896-54-138)
- 4:00 p.m. *A space with normal preimages.*
(10) **Timothy J. LaBerge**, Union College (896-54-158)
- 4:30 p.m. *Non-normal function spaces with countable extent.*
(11) **Winfried Just**, Ohio University, Athens, **Olga Sipacheva**, Moscow State University, Moscow, and **Paul Jan Szeptycki***, Ohio University, Athens (896-54-157)
- 5:00 p.m. *Some weaker monotone separation and local basis properties.*
(12) **Robert E. Buck**, Slippery Rock University of Pennsylvania (896-54-14)

Special Session on Operators on Banach Spaces of Analytic Functions, I

2:30 p.m.–5:20 p.m.

- 2:30 p.m. *Some open problems about composition operators on spaces of analytic functions.*
(13) **Carl C. Cowen, Jr.**, Purdue University, West Lafayette (896-47-62)
- 3:00 p.m. *Completely continuous composition operators.*
(14) **Joseph A. Cima**, University of North Carolina, Chapel Hill, and **Alec L. Matheson***, Lamar University (896-47-49)
- 3:30 p.m. *Invariant subspaces in Bergman spaces and Hedenmalm's boundary value problem.* Preliminary report.
(15) **Dmitry Khavinson***, University of Arkansas, Fayetteville, and **Harold S. Shapiro**, Royal Institute of Technology, Sweden (896-30-17)

Friday, November 11 (cont'd)

- 4:00 p.m. (16) *A rigidity theorem for composition operators on Bergman spaces.*
Thomas L. Kriete, III*, University of Virginia, and **Barbara D. MacCluer**, University of Richmond (896-47-95)
- 4:30 p.m. (17) *Zero sequences in Bergman spaces.* Preliminary report.
Daniel H. Luecking, University of Arkansas, Fayetteville (896-30-90)
- 5:00 p.m. (18) *Extensions of Szegő's theorem.* Preliminary report.
John Akeroyd, University of Arkansas, Fayetteville (896-46-04)

Special Session on Groups, Rings and Forms, I

2:30 p.m.–5:50 p.m.

- 2:30 p.m. (19) *On the order structure and the invariant subrings of finite groups.*
Lin Tan, West Chester University of Pennsylvania (896-13-100)
- 3:00 p.m. (20) *Projective invariants of four subspaces.*
Rosa Qi Huang, Virginia Polytechnic Institute and State University (896-13-71)
- 3:30 p.m. (21) *Groebner bases and Poincaré-Birkhoff-Witt bases.* Preliminary report.
Edward L. Green, Virginia Polytechnic Institute and State University (896-16-119)
- 4:00 p.m. (22) *Global and Krull dimensions of some quantizations of the Weyl algebra.*
Hisaki Fujita, University of Tsukuba, Japan, **Ellen E. Kirkman*** and **James J. Kuzmanovich**, Wake Forest University (896-16-59)
- 4:30 p.m. (23) *Invariants of $G/UxG/UxG/U$, $G = SL(4, C)$.*
Frank D. Grosshans, West Chester University of Pennsylvania (896-14-110)
- 5:00 p.m. (24) *Minimal prime ideals in enveloping algebras of nilpotent Lie superalgebras.*
Ellen E. Kirkman and **James J. Kuzmanovich***, Wake Forest University (896-16-60)
- 5:30 p.m. (25) *Bosonization of vertex operators for level one representations of quantum affine algebras of type D.*
Naihuan Jing, North Carolina State University (896-17-149)

Special Session on Codes and Designs, I

2:30 p.m.–5:50 p.m.

- 2:30 p.m. (26) *Some 2-group difference set designs and their codes.*
John F. Dillon, National Security Agency (896-05-145)
- 3:00 p.m. (27) *Factors of Hadamard difference sets.*
Ken W. Smith, Central Michigan University (896-05-99)
- 3:30 p.m. (28) *Quasi-cyclic codes built using finite field isomorphisms.* Preliminary report.
Roberta Evans Sabin, Loyola College (896-12-81)

- 4:00 p.m. (29) *Codes of $C(n, n, l)$ designs.* Preliminary report.
Chester J. Salwach, Lafayette College (896-05-82)
- 4:30 p.m. (30) *Difference sets modulo a prime.* Preliminary report.
Robert L. McFarland, University of Minnesota, Duluth (896-05-113)
- 5:00 p.m. (31) *(640, 72, 8) McFarland difference sets.* Preliminary report.
Jonathan Jedwab*, Hewlett-Packard Laboratory, United Kingdom, and **James A. Davis**, University of Richmond (896-05-125)
- 5:30 p.m. (32) *The 8×8 difference sets.*
Richard J. Turyn, Newton, Massachusetts (896-05-122)

Special Session on Quantum Mechanics, I

2:30 p.m.–4:30 p.m.

- 2:30 p.m. (33) *The Stark effect in atoms and molecules.*
Ira W. Herbst*, University of Virginia, **Jacob Moller** and **Erik Skibsted**, Aarhus University, Denmark (896-35-53)
- 3:15 p.m. (34) *Molecular propagation through avoided crossings of electron energy levels.*
George A. Hagedorn, Virginia Polytechnic Institute and State University (896-81-120)
- 4:00 p.m. (35) *Localization for magnetic Hamiltonians with random potentials.*
P. D. Hislop*, University of Kentucky, and **J. M. Combes**, University of Toulon, France (896-81-109)

Special Session on Nonassociative Algebras, I

2:30 p.m.–3:50 p.m.

- 2:30 p.m. (36) *Derivations and bimodules for a class of right alternative algebras.* Preliminary report.
R. D. Schafer, Massachusetts Institute of Technology (896-17-20)
- 3:00 p.m. (37) *Generalized derivations of algebras.*
Nora C. Hopkins, Indiana State University (896-17-42)
- 3:30 p.m. (38) *Lie algebras graded by a root system and structurable algebras.*
Oleg N. Smirnov, Russian Academy of Sciences, Russia (896-17-58)

Special Session on Stochastic Processes, I

2:30 p.m.–4:50 p.m.

- 2:30 p.m. (39) *Supremum norm estimates for trigonometric sums with random frequencies.*
George Benke*, Georgetown University, and **W. J. Hendricks**, Fairfax, Virginia (896-60-48)
- 3:00 p.m. (40) *Substable distributions.*
John P. Nolan, American University (896-60-144)
- 3:30 p.m. (41) *On the sharp Markov property for Gaussian random fields.*
Loren D. Pitt and **Raina Stefanova Robeva***, University of Virginia (896-60-30)

Program of the Sessions

- 4:00 p.m. *Ergodicity and mixing of stable processes.*
(42) **Jan Rosinski***, University of Tennessee, and
Gennady Samorodnitsky, Cornell University
(896-60-143)
- 4:30 p.m. *Applications of branching processes to generalized
recursive trees.*
(43) **Robert Smythe*** and **Hosam M. Mahmoud**, George
Washington University (896-60-148)

Special Session on Identities and Enumerations, I

2:30 p.m.–5:55 p.m.

- 2:30 p.m. *Pfaff's method and the WZ method.*
(44) **George E. Andrews**, Pennsylvania State University,
University Park (896-01-10)
- 2:50 p.m. *$U(n+1)$ bibasic summation formulas.*
(45) **Stephen C. Milne*** and **Gaurav Bhatnagar**, Ohio
State University, Columbus (896-33-31)
- 3:10 p.m. *$U(n+1)$ bibasic hypergeometric series.*
(46) **Stephen C. Milne** and **Gaurav Bhatnagar***, Ohio
State University, Columbus (896-33-32)
- 3:25 p.m. Break
- 3:45 p.m. *The coefficients of $\pi_1^\infty(1-x^n)^\mu(n)$.*
(47) **Gert Almkvist**, Lund University, Sweden (896-11-52)
- 4:05 p.m. *A proof of Lassalle's harmonic number conjecture.*
(48) **A. Di Bucchianico** and **Daniel E. Loeb***, University of
Bordeaux I, France (896-05-89)
- 4:25 p.m. *Identities and education.* Preliminary report.
(49) **Richard A. Askey**, University of Wisconsin, Madison
(896-98-87)
- 5:00 p.m. *Recursive statistics on words.* Preliminary report.
(50) **Jennifer R. Galovich***, Saint John's University, and
Dennis White, University of Minnesota, Minneapolis
(896-05-111)
- 5:20 p.m. *Congruences for colored partitions.*
(51) **Frank Garvan**, University of Florida (896-11-129)
- 5:40 p.m. *Survey of the Riordan group.*
(52) **Louis W. Shapiro**, Howard University (896-05-126)

Saturday, November 12

Special Session on Interpolation
and Dilation Theory, II

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Finitely generated ideals in H^∞ .*
(53) **Pamela B. Gorkin**, Bucknell University (896-47-98)
- 9:00 a.m. *Julia operators and a generalized Schur class.*
(54) Preliminary report.
James Rovnyak, University of Virginia (896-47-45)
- 9:30 a.m. *Isometries of certain operator algebras.*
(55) **Brian J. Cole** and **John Wermer***, Brown University
(896-47-56)
- 10:00 a.m. *Rational dilation on multiply connected domains.*
(56) **Jim Agler**, University of California at San Diego, La
Jolla (896-47-05)

- 10:30 a.m. *Optimal analytic disks.*
(57) **J. William Helton**, University of California at San
Diego, La Jolla (896-47-123)

Special Session on Groups, Rings and Forms, II

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Monoid Hecke algebras.*
(58) **Mohan S. Putcha**, North Carolina State University
(896-20-23)
- 9:00 a.m. *On weight multiplicities of some affine Lie algebra
representations.*
(59) **Kailash C. Misra**, North Carolina State University
(896-17-39)
- 9:30 a.m. *Homomorphisms in quotient categories and limits of
truncated Koszul complexes.*
(60) **Jon F. Carlson*** and **Wayne W. Wheeler**, University
of Georgia (896-20-19)
- 10:00 a.m. *A computer investigation in representation theory.*
(61) **Leonard Scott**, University of Virginia (896-20-118)
- 10:30 a.m. *Automorphisms of semi-local group rings.*
(62) **Peter Floodstrand Blanchard**, University of Virginia
(896-20-135)

Special Session on Codes and Designs, II

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *A family of divisible lexicographic codes.*
(63) **Harold N. Ward**, University of Virginia (896-94-84)
- 9:00 a.m. *More on existence and uniqueness of binary linear
codes.*
(64) **George T. Kennedy**, National Security Agency
(896-94-133)
- 9:30 a.m. *An updated survey of covering radius.*
(65) **Gerard D. Cohen**, **Simon N. Litsyn**, **H. F. Mattson,
Jr.*** and **Antoine Lobstein**, Syracuse University
(896-94-142)
- 10:00 a.m. *Z_4 quadratic residue codes.*
(66) **Vera S. Pless**, University of Illinois, Chicago
(896-05-83)
- 10:30 a.m. *Partition designs and two-weight codes.* Preliminary
report.
(67) **Paul F. Camion**, Institute National de Research en
Information, France (896-12-78)

Special Session on Quantum Mechanics, II

8:30 a.m.–10:45 a.m.

- 8:30 a.m. *Anderson localization.*
(68) **Michael Aizenman**, Princeton University (896-81-121)
- 9:30 a.m. *Asymptotics for Schrödinger operators on spheres and
tori.* Preliminary report.
(69) **Lawrence E. Thomas**, University of Virginia
(896-81-91)
- 10:15 a.m. *Quantum stability.*
(70) **James S. Howland**, University of Virginia
(896-81-136)

Saturday, November 12 (cont'd)

Special Session on Nonassociative Algebras, II

8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Quadratic Jordan superalgebras. Preliminary report.*
(71) **Daniel L. King***, Oberlin College, and **Kevin M. McCrimmon**, University of Virginia (896-17-76)
- 9:00 a.m. *Quadratic Jordan systems of Clifford type.*
(72) **Alain D'Amour***, Denison University, and **Kevin M. McCrimmon**, University of Virginia (896-17-41)
- 9:30 a.m. *Speciality of quadratic Jordan algebras.*
(73) **Jacqueline Anderson Hall**, Hampden-Sydney College (896-17-93)
- 10:00 a.m. *Grassmann speciality.*
(74) **Kevin M. McCrimmon**, University of Virginia (896-17-77)
- 10:30 a.m. Discussion

Special Session on Set Theoretic Topology and Set Theory, II

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Maximal Feebly compact expansions.*
(75) **Jack R. Porter**, University of Kansas, **Robert M. Stephenson, Jr.***, University of South Carolina, Columbia, and **R. Grant Woods**, University of Manitoba (896-54-154)
- 9:30 a.m. *Compact scattered spacers, tightness, depth, and π -character.*
(76) **Alan Dow***, York University, and **J. Donald Monk**, University of Colorado, Boulder (896-54-134)
- 10:00 a.m. *Compact Hausdorff spaces with moderately large families of convergent sequences.*
(77) **Alan Dow**, York University, and **Peter Nyikos***, University of South Carolina, Columbia (896-54-150)
- 10:30 a.m. *Countably compact, nearly metaLindelöf spaces.*
(78) **Jerry E. Vaughan**, University of North Carolina, Greensboro (896-54-159)

Special Session on Stochastic Processes, II

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Some Banach spaces of vector valued functions and an extremal problem.*
(79) **Ray Cheng**, University of Louisville (896-60-12)
- 9:30 a.m. *Sharper estimates on the lifetimes of Brownian motion in convex domains with bounded inradius.*
(80) **Rodrigo Bañuelos**, Purdue University, West Lafayette, **Tom Carroll**, Milan, Italy, and **Elizabeth Ann Housworth***, University of Oregon (896-30-11)
- 10:00 a.m. *On prediction of multivariate stationary stochastic processes of rank one.*
(81) **Abol G. Miamee**, Hampton University (896-60-161)

- 10:30 a.m. *A probabilistic approach to scaling functions.*
(82) **A. O. Pittenger**, University of Maryland, Baltimore County (896-42-37)

Special Session on Identities and Enumerations, II

9:00 a.m.–10:45 a.m.

- 9:00 a.m. *An inverse of the Wilson difference operator. Preliminary report.*
(83) **Shaun Cooper**, University of Wisconsin, Madison (896-33-116)
- 9:20 a.m. *Constructible differentially finite algebraic series in several variables.*
(84) **Francois Bergeron***, University of Quebec at Montreal, and **Ulrike Sattler**, University of Erlangen-Nurnberg, Germany (896-05-21)
- 9:40 a.m. *Combinatorial problems related to the study of natural exponential families on R^n .*
(85) **I-Li Lu**, Medical College of Virginia, and **Donald St. P. Richards***, University of Virginia (896-60-64)
- 9:55 a.m. Break
- 10:10 a.m. *Counting pairs of nonintersecting lattice paths with respect to various parameters.*
▶ (86) **Robert A. Sulanke**, Boise State University (896-05-75)
- 10:30 a.m. *Heine transformations for a new kind of basic hypergeometric series on $U(n)$.*
(87) **Robert A. Gustafson***, Texas A & M University, College Station, and **Christian Krattenthaler**, University of Vienna, Austria (896-33-112)

Session on Contributed Papers

9:30 a.m.–10:55 a.m.

- 9:30 a.m. *MapleCalc. Preliminary report.*
(88) **John J. Avioi**, Christopher Newport University (896-98-01)
- 9:45 a.m. *Involutory commutants of the sixth order with applications to algebraic cryptography.*
(89) **Neil Phillip Sigmon**, North Carolina State University (896-15-27)
- 10:00 a.m. *P_3 -isomorphisms for graphs of minimum degree at least 2.*
(90) **R. Aldred**, University of Otago, New Zealand, **Mark N. Ellingham**, **Robert L. Hemminger*** and **Peter Jipsen**, Vanderbilt University (896-05-85)
- 10:15 a.m. *Notes on the local Hopf's lemma.*
(91) **Vladimir Shklover**, University of Maryland, College Park (896-30-26)
- 10:30 a.m. *A central limit theorem for Kawasaki-type dynamics.*
(92) **Sunder Sethuraman***, Courant Institute of Mathematical Sciences, New York University, and **Lin Xu**, University of California, Irvine (896-60-107)
- 10:45 a.m. *Singularity index theorem and its applications.*
(93) **Jinghuang Tian**, Institute of Mathematical Sciences, People's Republic of China (896-99-163)

Program of the Sessions

Invited Address

11:10 a.m.–noon

- (94) *Lifting weights for fun and profit.*
Cora Sadosky, Howard University (896-47-54)

Invited Address

1:10 p.m.–2:00 p.m.

- (95) *'=*.
Doron Zeilberger, Temple University (896-05-55)

Special Session on Set Theoretic
 Topology and Set Theory, III

2:15 p.m.–5:05 p.m.

- 2:15 p.m. *Topological semi-groups on linearly ordered topological spaces.*
 (96) **Robert W. Heath**, University of Pittsburgh (896-54-160)
- 2:45 p.m. *On the Arhangel'skii-Tall problem. I.*
 (97) **Gary F. Gruenhage*** and **Piotr Boleslaw Koszmider**, Auburn University, Auburn (896-54-152)
- 3:15 p.m. *On the Arhangel'skii-Tall problem. II.*
 (98) **Gary F. Gruenhage** and **Piotr Boleslaw Koszmider***, Auburn University, Auburn (896-54-153)
- 3:45 p.m. *Forcing and normality.*
 (99) **Franklin D. Tall**, University of Toronto (896-54-155)
- 4:15 p.m. *Dimension of a set in l_p as p varies.*
 (100) **John S. Kulesza**, George Mason University (896-54-151)
- 4:45 p.m. *Forcing and diamond axioms. Preliminary report.*
 (101) **William G. Fleissner**, University of Kansas (896-54-162)

Special Session on Operators on
 Banach Spaces of Analytic Functions, II

2:15 p.m.–5:05 p.m.

- 2:15 p.m. *Some sufficient conditions for invariant subspaces to have the codimension one property.*
 (102) **Alexandru Aleman**, Fern University, Germany, and **Stefan Richter***, University of Tennessee, Knoxville (896-47-61)
- 2:45 p.m. *Inclusion properties of \mathcal{I} -invariant subspaces of the Bergman space. Preliminary report.*
 (103) **Boris Korenblum**, State University of New York, Albany (896-30-68)
- 3:15 p.m. *Adamyran-Arov-Krein parametrization of solutions of the Nehari and Takagi problems for $H^\infty + C$ matrix functions.*
 (104) **Vladimir V. Peller***, Kansas State University, and **Nicholas J. Young**, University of Lancaster, England (896-47-106)
- 3:45 p.m. *Nehari's problem via a fixed point theorem.*
 (105) **A. L. Volberg**, Michigan State University (896-47-139)

- 4:15 p.m. *Hankel operators and invariant subspaces on the Bergman space.*
 (106) **Kehe Zhu**, State University of New York, Albany (896-47-15)
- 4:45 p.m. *The local Dirichlet integral and the local Bergman integral.*
 (107) **Carl Sundberg**, University of Tennessee (896-47-140)

Special Session on Groups, Rings and Forms, III

2:15 p.m.–5:35 p.m.

- 2:15 p.m. *Polar spaces over form rings.*
 (108) **Donald G. James**, Pennsylvania State University, University Park (896-51-34)
- 2:45 p.m. *The elements of the orthogonal group $\omega_n(V)$ as products of commutators of symmetries.*
 (109) **Alexander J. Hahn**, University of Notre Dame (896-13-40)
- 3:15 p.m. *Coding of closed geodesics after Gauss and Morse.*
 (110) **Svetlana R. Katok**, Pennsylvania State University, University Park (896-20-108)
- 3:45 p.m. *Normal subgroups of $O_4(R)$.*
 (111) **Anne B. Pilkington**, Florida International University (896-20-38)
- 4:15 p.m. *Abstract radices. Preliminary report.*
 (112) **Douglas Costa*** and **Gordon Keller**, University of Virginia (896-20-70)
- 4:45 p.m. *A homomorphism on $SL(2A)$.*
 (113) **Gordon Keller*** and **Douglas Costa**, University of Virginia (896-13-117)
- 5:15 p.m. *Elementary orbit sets of unimodular vectors. Preliminary report.*
 (114) **Edward K. Hinson**, University of New Hampshire (896-19-51)

Special Session on Codes and Designs, III

2:15 p.m.–4:35 p.m.

- 2:15 p.m. *Codes over the integers modulo 4 and exponential sums.*
 (115) **A. R. Calderbank**, AT&T Bell Laboratories, Murray Hill, New Jersey (896-52-102)
- 2:45 p.m. *The antipode construction for sphere packings.*
 (116) **John Horton Conway**, Princeton University, and **N. J. A. Sloane***, AT&T Bell Laboratories, Murray Hill, New Jersey (896-52-103)
- 3:15 p.m. *On Lander's tables.*
 (117) **Joel Iiams**, Colorado State University (896-51-63)
- 3:45 p.m. *On finite flag transitive projective planes. Preliminary report.*
 (118) **Robert A. Liebler**, Colorado State University (896-51-94)
- 4:15 p.m. *The automorphism groups of the generalized quadratic residue codes.*
 (119) **W. Cary Huffman**, University of Chicago (896-94-80)

Saturday, November 12 (cont'd)

Special Session on Quantum Mechanics, III

2:15 p.m.–4:15 p.m.

- 2:15 p.m. *Quantization for motion on a compact Lie group.*
(120) Preliminary report.
Brian C. Hall, University of Virginia (896-81-67)
- 3:00 p.m. *Inverse wave scattering with discontinuous wavespeed.*
(121) **Tuncay Aktosun**, North Dakota State University, Fargo, **Martin Klaus***, Virginia Polytechnic Institute and State University, and **Cornelis van der Mee**, University of Cagliari, Italy (896-34-46)
- 3:45 p.m. *The simplified Fermi map in classical and quantum mechanics.*
(122) **Gunther Heinz Karner**, University of Virginia (896-34-47)

Special Session on Nonassociative Algebras, III

2:15 p.m.–4:05 p.m.

- 2:15 p.m. *Steinberg groups for Jordan pairs.*
(123) **Barbara A. Leasher**, Providence College (896-17-57)
- 2:45 p.m. *Steinberg groups and nonassociative rings.*
(124) Preliminary report.
John R. Faulkner, University of Virginia (896-17-43)
- 3:15 p.m. *Homomorphisms of remotely projective planes.*
(125) **Catherine A. Moore**, University of Virginia (896-17-92)
- 3:45 p.m. *Gyrogroups, symmetric spaces, and Lie triple systems.*
(126) **Michael Kenneth Kinyon**, Indiana University, South Bend (896-17-101)

Special Session on Stochastic Processes, III

2:15 p.m.–4:05 p.m.

- 2:15 p.m. *Random Fourier series, random covering, and connectedness of random graphs.*
(127) **L. A. Shepp**, AT&T Bell Laboratories, Murray Hill, New Jersey (896-60-02)
- 2:45 p.m. *Energy of Markov chains.*
(128) **Ryszard Syski**, University of Maryland, College Park (896-60-22)
- 3:15 p.m. *Defining fractals in a probability space.*
(129) **Chaoshou Dai**, Xuzhou Teachers College, People's Republic of China, and **S. James Taylor***, University of Virginia (896-60-36)
- 3:45 p.m. *Critical probability bounds in percolation models.*
(130) Preliminary report.
John C. Wierman, Johns Hopkins University (896-60-24)

Special Session on Identities and Enumerations, III

2:15 p.m.–5:25 p.m.

- 2:15 p.m. *Integrals of polynomials associated with tableaux.*
(131) **Charles F. Dunkl***, University of Virginia, and **Phil Hanlon**, University of Michigan, Ann Arbor (896-05-65)
- 2:35 p.m. *An application of P. I. theory to S_n characters.*
(132) **Amitai Regev**, Pennsylvania State University, University Park and Weizmann Institute, Germany (896-05-131)
- 2:55 p.m. *A new formula for Hall polynomials.*
(133) **F. Miller Maley**, Princeton University (896-05-147)
- 3:10 p.m. Break
- 3:30 p.m. *Monotonicity theorems for partitions.*
(134) **Jane Friedman**, University of San Diego, **James T. Joichi** and **D. Stanton***, University of Minnesota, Minneapolis (896-05-08)
- 3:50 p.m. *The monotonicity conjecture for Macdonald's two variable Kostka functions.*
(135) **Lynne M. Butler**, Haverford College (896-05-130)
- 4:10 p.m. *Hopf algebras of Young tableaux.*
(136) **Stephane Poirier** and **Christophe Reutenauer***, University of Quebec at Montreal (896-05-16)
- 4:30 p.m. *Symplectic Schensted algorithms.*
(137) **Jeffrey T. Sheats**, University of North Carolina, Chapel Hill (896-05-25)
- 4:50 p.m. *On Lie k -Algebras.*
(138) **Phil Hanlon**, University of Michigan, Ann Arbor, and **Michelle L. Wachs***, University of Miami (896-05-88)
- 5:10 p.m. *On the unimodality of certain representations of the symmetric group.*
(139) **Sheila Sundaram**, University of Miami (896-05-137)

Sunday, November 13

Special Session on Operators on Banach Spaces of Analytic Functions, III

8:30 a.m.–11:20 a.m.

- 8:30 a.m. *Local spectral theory and function-theoretic operators.*
(140) **R. C. Smith**, Mississippi State University (896-47-114)
- 9:00 a.m. *Interpolating sequences in de Branges-Rovnyak spaces.*
(141) **Benjamin A. Lotto***, Vassar College, and **John E. McCarthy**, Washington University (896-46-105)
- 9:30 a.m. *Composition operators on spaces of analytic functions.*
(142) **Barbara D. MacCluer**, University of Richmond (896-47-18)
- 10:00 a.m. *Invariant subspaces of a crescent.* Preliminary report.
(143) **Alexandru Aleman**, Fern University, Germany, and **Robert F. Olin***, Virginia Polytechnic Institute and State University (896-47-124)
- 10:30 a.m. *On boundedness of composition operators.* Preliminary report.
(144) **Joseph A. Cima** and **Warren R. Wogen***, University of North Carolina, Chapel Hill (896-47-104)

Program of the Sessions

- 11:00 a.m. *Rationally cyclic subnormal operators with finite rank self-commutators.*
(145) **John E. McCarthy** and **Liming Yang***, Washington University (896-47-66)

Special Session on Codes and Designs, IV

9:00 a.m.–11:50 a.m.

- 9:00 a.m. *On arc subgroups of a cyclic plane.*
(146) **Chat Yin Ho**, University of Florida (896-20-96)
- 9:30 a.m. *Using the simplex code to construct relative difference sets in 2-groups.*
(147) **James A. Davis**, University of Richmond, and **Surinder Sehgal***, Ohio State University, Columbus (896-05-35)
- 10:00 a.m. *K-matrices revisited.*
(148) **James A. Davis**, University of Richmond (896-05-132)
- 10:30 a.m. *Characters and codes over self-injective rings.*
(149) **Jay A. Wood**, Purdue University, Calumet Campus (896-94-127)
- 11:00 a.m. *New necessary conditions for Abelian Hadamard difference sets.*
(150) **Dwijendra Ray-Chaudhuri** and **Qing Xiang***, Ohio State University, Columbus (896-05-28)
- 11:30 a.m. *Abelianization of difference sets.*
(151) **Dwijendra Ray-Chaudhuri*** and **Xiaohong Wu**, Ohio State University, Columbus (896-05-79)

Special Session on Identities and Enumerations, IV

9:00 a.m.–11:30 a.m.

- 9:00 a.m. *Enumerating two-stack-sortable multipermutations.*
(152) **Ira M. Gessel**, Brandeis University (896-05-29)
- 9:20 a.m. *Identities and enumeration: Weighting connected components.* Preliminary report.
(153) **Gilbert Labelle*** and **Pierre Leroux**, University of Quebec at Montreal (896-05-73)

- 9:40 a.m. *Log concavity properties of cycle index polynomials.*
(154) **Rod Canfield***, University of Georgia, and **Edward A. Bender**, University of California at San Diego, La Jolla (896-05-86)

9:55 a.m. Break

- 10:15 a.m. *Rook theory, compositions, and zeta functions.*
(155) **James Haglund**, Kennesaw State College (896-11-44)
- 10:35 a.m. *A bijection between maximal chains in the lattices $Fib(r)$ and $Z(r)$.*
(156) **Darla J. Kremer**, George Washington University (896-05-156)
- 10:55 a.m. *Hook length and d -complete posets.*
(157) **Robert A. Proctor**, University of North Carolina, Chapel Hill (896-05-74)
- 11:15 a.m. *Sheffer posets and r -signed permutations.*
(158) **Richard Ehrenborg*** and **Margaret A. Readdy**, University of Quebec at Montreal (896-06-128)

Special Session on Interpolation and Dilation Theory, III

9:30 a.m.–11:20 a.m.

- 9:30 a.m. *Extrapolation in multiresolutions.*
(159) **Hugo J. Woerdeman***, College of William and Mary, and **Akram Aldroubi**, National Institute of Health (896-42-50)
- 10:00 a.m. *Tensor generalization of singular values.*
(160) **Chandler Davis**, University of Toronto (896-47-97)
- 10:30 a.m. *On an indefinite trigonometric moment problem of I.S. Iohvidov and M.G. Krein.*
(161) **Tiberiu Constantinescu***, University of Texas, Dallas, and **Aurelian Gheondea**, Institute of Mathematics of the Romanian Academy, Romania (896-47-13)
- 11:00 a.m. *Contractive completions of Hankel partial contractions.*
(162) **Raúl E. Curto**, University of Iowa (896-47-03)

Robert J. Daverman
Associate Secretary
Knoxville, Tennessee

Discussion of January Meeting Dates

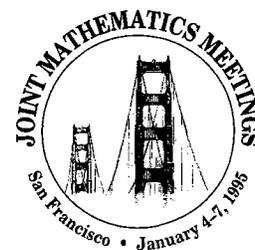
In an attempt to make the January Joint Mathematics Meetings accessible to the largest possible segment of the community, the AMS-MAA Joint Meetings Committee (JMC) has, for the past several years, tried to rotate the dates of these meetings among the first, second, and third weeks in January, and alternate the sites between locations east (in even-numbered years) and west (in odd-numbered years) of the Mississippi River.

The dates and locations have been chosen based on a number of factors. The lowest hotel rates are obtainable during the first week in January and these rates increase as the weeks go by so that by the first week in February, they may be as much as 20 to 35 percent higher. These meetings require an unusually large number of simultaneous meeting rooms, and availability of facilities able to provide this space is more likely during the first three weeks of January than at other times during the year. A study done a few years ago by *The Chronicle of Higher Education* indicated that most schools are on break during this period, particularly the first and second weeks. The JMC made a conscious effort to keep the meeting dates during this time frame. Over the past

several years the JMC has received only isolated complaints regarding the meeting dates until recently, when a number of participants at the the meetings in Cincinnati (January 12–15, 1994) explained that meetings in these weeks cause conflict for many with the first week of classes or with registration, and that preference would be for a meeting in early February, which would conflict with the second or third week of classes instead.

Other factors taken into consideration when a site is chosen are costs (both to the participant and to the sponsoring organizations), climate, ease of access from most airline hubs, quick and inexpensive local transportation services, and an attractive and interesting environment.

It is the desire of the JMC to make these meetings as accessible as possible to everyone in the community. The JMC solicits comments and opinions on the desirability of various meeting times and locations. Please forward your comments, suggestions, and ideas to the JMC by sending e-mail to hhd@math.ams.org, or by surface mail to AMS-MAA Joint Meetings Committee, c/o AMS Meetings & Conferences Department, P.O. Box 6887, Providence, RI 02940.



Joint Mathematics Meetings

San Francisco, California, January 4-7, 1995

First Announcement

The Scientific Program

The January 1995 Joint Mathematics Meetings, including the 101st Annual Meeting of the AMS, the 78th Annual Meeting of the Mathematical Association of America, and the 1995 annual meetings of the Association of Symbolic Logic, the Association for Women in Mathematics, and the National Association for Mathematicians, will be held January 4-7 (Wednesday-Saturday), 1995, in San Francisco, California. Sessions will be held in the San Francisco Hilton on Hilton Square and in the Parc Fifty-Five.

AMS-MAA Invited Addresses

Doris J. Schattschneider, Moravian College, *Ingenious mathematical amateurs: M. C. Escher (artist) and Marjorie Rice (homemaker)*, Friday 11:10 a.m.; and

David A. Cox, Amherst College, *The algebra of solving polynomial equations*, Wednesday, 11:10 a.m.

Other AMS-MAA Sessions

Special Sessions: Mathematics and education reform, organized by **Naomi Fisher**, University of Illinois at Chicago; **Harvey B. Keynes**, University of Minnesota, Minneapolis; **Kenneth C. Millett**, University of California at Santa Barbara; **Hugo Rossi**, University of Utah; and **T. Christine Stevens**, Saint Louis University. Wednesday afternoon and Thursday morning and afternoon. Also cosponsored by the Mathematicians and Education Reform (MER) Network.

IMPORTANT DEADLINES

AMS Abstracts	
For Consideration for Special Sessions Of Contributed Papers	Expired
MAA Abstracts of Contributed Papers	Expired
EARLY Meetings Advance Registration and Housing (Room Lottery); materials mailed	November 9
ORDINARY Meetings Advance Registration/Housing/Tickets	November 16
Employment Register Advance Registration	November 16
MAA Minicourse Advance Registration	November 16
Hotel Changes and Cancellations with MMSB	December 1
FINAL Meetings Advance Registration (no housing or tickets)	December 7
Motions for AMS Business Meeting	December 7
Cancellations for Banquets/Tour (50% refund)	December 23
Advance Registration Cancellations (50% refund)	December 30
Employment Register Cancellations (50% refund)	December 30

Research in undergraduate mathematics education, organized by **Daniel L. Goroff**, Harvard University, and **Joan Ferrini-Mundy**, University of New Hampshire, Friday evening and Saturday afternoon. Sponsored by the AMS-MAA Committee on Research in Undergraduate Mathematics Education.

You're the Professor, What Next?: Friday, 9:30 a.m. to 10:55 a.m. This panel and discussion, with the same name as the new *MAA Notes* 35, is sponsored by the JPBM-initiated Committee on Preparation for College Teaching (a joint AMS-MAA-SIAM committee) and organized by **Betty Anne Case**, Florida State University.

GRE Mathematics Reasoning Examination: Friday, 9:30 a.m. to 10:55 a.m. This panel discussion is sponsored by the AMS Committee on Education and the MAA Education Council and is organized by **Alan Tucker**, SUNY at Stony Brook. In fall 1997 the GRE General Test will be reorganized with a new Mathematical Reasoning test that will have a calculus prerequisite. Its questions will include visualization and applied interpretation problems of the sort found in most reformed calculus courses. Members of this panel from ETS, MAA, and AMS will give information about this test and its expected impact.

Other AMS-MAA Events

Mathchats and Graduate Student Reception: On Tuesday evening well-known mathematicians representing a wide range of disciplines (Tom Banchoff, Donna Beers, Lenore Blum, Fan Chung, Annalisa Crannell, Florence Fasanelli, Judy Green, Bill Hawkins, Victor Katz, Linda Keen, Laura Kelleher, Barbara Leasher, Jim Lightbourne, Pat McCray, Fred Rickey, Ken Ross, Doris Schattschneider, Martha Siegel, Phil Straffin, Ann Watkins, Silvia Wiegand, and others) will join interested graduate students for informal chats; all graduate students are invited. Participants will meet in the main lobby of the Hilton at 5:30 p.m. and will walk to a local Chinese restaurant for dinner. Return is at your leisure.

NOTE: This event is only for students who sign up in advance on the Advance Registration Form. There is no charge.

Reception for First-time Attendees: The AMS Committee on Membership and the MAA Committee on Membership are cosponsoring a social hour on Wednesday from 6:00 p.m. to 7:00 p.m. If this is your first national meeting, you are especially encouraged to come and meet some old-timers and pick up a few tips on how to survive the environment of a large meeting. The program will include a 20- to 30-minute magic

show put on by **S. Brent Morris**, MAA governor-at-large representing Mathematicians Outside Academia. Refreshments will be served.

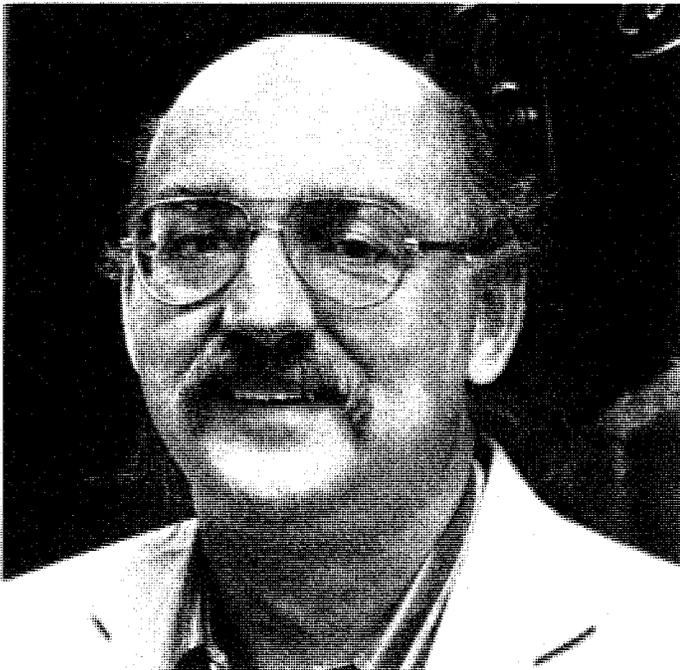
Joint Prize Session and Reception: In order to showcase the achievements of the recipients of various prizes, the AMS and MAA are cosponsoring this event at 4:25 p.m. on Thursday. A cash bar reception will immediately follow. All participants are invited to attend. The AMS will announce the recipients of the Cole Prize, the Satter Prize, the Norbert Wiener Prize in Applied Mathematics, and the Award for Distinguished Public Service. The AWM will present the Louise Hay Award for Contributions to Mathematics Education. The MAA prizes to be awarded include the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics, the Chauvenet Prize, the Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics, and Certificates of Meritorious Service.

101st Annual Meeting of the AMS January 4–7, 1995

Invited Addresses

Sixty-eighth Josiah Willard Gibbs Lecture: *Turbulence, turbulent diffusion, and modern applied mathematics*, **Andrew J. Majda**, Princeton University, 8:30 p.m. on Wednesday.

Colloquium Lectures: Lecture I: *Mysteries in three and four dimensions*, Lecture II: *Mysteries in four dimensions*, Lecture III: *Mysteries in three dimensions*; **Clifford Taubes**, Harvard University, 1:00 p.m. daily, Wednesday through Friday.



Andrew J. Majda, Gibbs Lecturer

Jerry L. Bona, Pennsylvania State University, *Solitary waves, tsunamis, and sand bars*, Wednesday, 9:00 a.m.;

Alexander B. Givental, University of California, Berkeley, *Mirror symmetry: A bridge between singularity theory and symplectic topology*, Friday, 10:05 a.m.;

Jeff Kahn, Rutgers University, *Random matchings*, Thursday, 2:15 p.m.;

John William Lott, University of Michigan, *How slow can heat flow?*, Friday, 9:00 a.m.;

Leila Schneps, Laboratoire de Mathématiques, Besançon Cedex, France, *Grothendieck-Teichmüller theory*, Thursday, 3:20 p.m.; and

John Smillie, Cornell University, *Complex analytic dynamics in two dimensions*, Wednesday, 10:05 a.m.

Special Sessions and Contributed Papers

(See also the AMS-MAA Special Sessions.)

Cohomology and representations of finite groups, **Alex Adem**, University of Wisconsin-Madison, and **Jon F. Carlson**, University of Georgia; Thursday evening and Friday afternoon.

Nonlinear elliptic boundary value problems and applications, **Walter Allegretto**, University of Alberta, **Alfonso Castro**, University of North Texas, and **Ratnasingham Shivaji**, Mississippi State University; Friday evening and Saturday morning and afternoon.

History of mathematics, **Thomas Archibald**, Acadia University, and **Victor J. Katz**, University of District of Columbia, Saturday morning and afternoon.

The simple group classification: Second generation proof and applications, **Michael Aschbacher**, Caltech, and **Stephen D. Smith**, University of Illinois at Chicago; Wednesday afternoon and Thursday morning and afternoon.

Complex dynamics, **Eric D. Bedford**, Indiana University, and **John Smillie**, Cornell University; Wednesday afternoon and Thursday morning and afternoon.

Undergraduate research, **David C. Carothers**, Hope College, Friday evening and Saturday morning and afternoon.

Graph theory, **Gary Chartrand**, Western Michigan University, and **Michael S. Jacobson**, University of Louisville; Friday evening and Saturday morning and afternoon.

Difference equations: Theory and applications, **Saber N. Elaydi**, Trinity University, and **John R. Graef**, Mississippi State University; Thursday evening and Friday afternoon.

Environmental modeling, **Ben A. Fusaro**, Salisbury State University, and **Suzanne M. Lenhart**, University of Tennessee; Saturday morning and afternoon.

Discrete geometry, **Jacob E. Goodman** and **Janos Pach**, City College (CUNY); Thursday evening and Friday afternoon.

Geometric function theory in one and several complex variables, **Ian Graham**, University of Toronto, and **David Minda**, University of Cincinnati; Friday afternoon and evening and Saturday morning.

Multivalued dynamical systems and applications, **Shou-chuan Hu** and **Nikolaos S. Papageorgiou**, Florida Institute

of Technology; Friday afternoon and evening and Saturday morning.

Probability and combinatorics, **Jeff Kahn**, Rutgers University, and **Robin A. Pemantle**, University of Wisconsin, Madison; Thursday morning and evening and Friday morning and afternoon.

Theory and applications of nonlinear operators of accretive and monotone type, **A. G. Kartsatos**, University of Florida; Saturday morning and afternoon.

Noncommutative algebra, **Ellen E. Kirkman** and **James J. Kuzmanovich**, Wake Forest University; Friday afternoon and evening and Saturday morning.

Numerical solution for integro-differential equations, **Yanping Lin**, University of Alberta, Thursday evening and Friday afternoon.

Almost multiplicative maps, C^ -algebras, and deformations*, **Terry A. Loring**, University of New Mexico; Wednesday afternoon, and Thursday morning and afternoon.

Index theory and elliptic operators on manifolds, **John William Lott**, University of Michigan, and **Rafe R. Mazzeo**, Stanford University; Friday evening, and Saturday morning and afternoon.

Holomorphic spaces, **Benjamin A. Lotto**, Vassar College; Thursday evening and Friday morning and afternoon.

Effective approaches to the training of teaching assistants, **Suzanne M. Lenhart**, University of Tennessee, and **Daniel Madden**, National Science Foundation; Friday afternoon and evening and Saturday morning.

Model theory, **David E. Marker**, University of Illinois at Chicago, and **Charles I. Steinhorn**, Vassar College; Wednesday morning and afternoon and Thursday morning.

Non self adjoint operator algebras, **John L. Orr** and **David R. Pitts**, University of Nebraska; Thursday evening and Friday afternoon.

Extremal Riemann surfaces, **Jack Quine**, Florida State University, and **Peter Sarnak**, Princeton University; Wednesday morning and afternoon and Thursday morning.

Homotopy theory, **Douglas C. Ravenel**, University of Rochester; Saturday morning and afternoon.

Stochastic systems and applications, **Sivapragasam Sathananthan**, Tennessee State University; Wednesday afternoon and Thursday morning and afternoon.

Nonlinear dynamics, **Seenith Sivasundaram**, Embry Riddle Aeronautical University; Thursday evening and Friday morning and afternoon.

Applied Logic, **Curtis Tuckey**, AT&T Bell Laboratories; Thursday evening and Friday morning and afternoon.

Commutative algebra: Rees algebras and related topics, **Bernd Ulrich**, Michigan State University, and **Wolmer V. Vasconcelos**, Rutgers University; Thursday evening and Friday morning and afternoon.

Commutative Noetherian rings and modules, **Roger A. Wiegand** and **Sylvia M. Wiegand**, University of Nebraska; Wednesday morning and afternoon and Thursday morning.

Contributed Papers: There will be sessions for con-

tributed papers of ten minutes' duration. Contributed papers will be grouped by related *Mathematical Reviews* subject classifications into sessions, insofar as possible. The title of each paper accepted and the time of presentation will be listed in the program of the meeting.

Unfortunately, all deadlines for submitting papers for AMS sessions have expired.

Other AMS Sessions

Applications of Internet Technologies for Mathematics: Wednesday, 9:00 a.m. to 10:00 a.m. AMS staff will present an overview of current Internet technologies, targeting how these technologies can be applied to disseminate mathematical information over the Internet. Staff will describe Internet access tools such as ftp/telnet, gopher, World Wide Web, etc., and discuss how to obtain, install, and utilize such tools. A question-and-answer period will follow. Organized by **Ralph E. Youngen** and **Wendy Bucci**, AMS.

Mathematics in Industry: Wednesday, 4:30 p.m. to 5:30 p.m. Sponsored by the Committee on the Profession. **Paul Davis**, Worcester Polytechnic Institute, will give this presentation regarding SIAM's project of the same name. Questions from the audience will be solicited.

Access and Archiving in the Electronic Age: Friday, 9:00 a.m. to 10:30 p.m. This panel discussion sponsored by the AMS Library Committee will include **Richard A. Askey**, University of Wisconsin; **Donald G. Babbitt**, Publisher, AMS; **Carol Hutchins**, Library Director, New York University-Courant Institute; and **Herbert S. Wilf**, University of Pennsylvania.

Computational Chemistry: Friday, 9:25 a.m. to 10:55 a.m. **De Witt L. Sumners**, Florida State University, will give a general overview of the National Research Council Committee on Mathematical Challenges from Computational Chemistry (Frank H. Stillinger, Bell Labs, chair) program on opportunities for collaborative and synergistic research in the mathematical sciences that can accelerate progress in theoretical and computational chemistry and their applications. The overview will be followed by presentations from **Peter A. Kollman**, Department of Pharmaceutical Chemistry, University of California, San Francisco; and **William A. Lester, Jr.**, Department of Chemistry, University of California, Berkeley. These scientists, who are committee members, will speak on mathematics research opportunities in their own research areas. There will be an open round-table discussion after the talks for fielding questions from the audience.

Committee on Science Policy Panel Discussion: Friday, 3:15 p.m. to 4:45 p.m.

e-MATH Overview: Friday, 3:30 p.m. to 4:30 p.m. AMS staff members will present an overview of e-MATH, the Society's Internet delivery system for mathematical information. Staff will discuss the history of e-MATH, how to access it, current services, and future developments. Organized by **Ralph E. Youngen** and **Wendy A. Bucci**, AMS.

Committee on Science Policy Government Speaker: Friday, 5:00 p.m. to 5:50 p.m.

Looking for a Job in Industry: Friday, 7:00 p.m. to 8:20 p.m. Sponsored by the Committee on the Profession. **Stanley J. Benkoski**, Wagner Associates, will give this presentation, with ample time for audience participation.

Can We Evaluate Teaching or Research in the Mathematical Sciences?: Saturday, 8:30 a.m. to 10:00 a.m. Panel discussion sponsored by the Committee on Education.

Other AMS Events

Mathematical Reviews (MR) Reception: Friday, 5:15 p.m. to 6:15 p.m. All reviewers are encouraged to come to the reception, and others who are interested in *MR* are also invited. Members of the *MR* Editorial Committee and the *MR* staff will make some brief comments, and there will be an opportunity for reviewers to ask questions and make comments and suggestions. Refreshments will be provided.

Council Meeting: Saturday, 9:00 a.m. to 6:00 p.m.

Business Meeting: Saturday, 11:45 a.m. to 12:15 p.m.

Agenda: Introductions, minutes of the last meeting, reports from the secretary and the president, new business for referral to future business meetings and/or the Council and Board of Trustees, report of the Committee on the Agenda for Business Meetings (if any), Resolution of Thanks to the Local Arrangements Committee, adjournment.

The secretary notes the following resolution of the Council: *Each person who attends a Business Meeting of the Society shall be willing and able to identify himself as a member of the Society.* In further explanation, it is noted that *each person who is to vote at a meeting is thereby identifying himself as and claiming to be a member of the American Mathematical Society.*

The Society has a Committee on the Agenda for Business Meetings. The purpose is to make Business Meetings orderly and effective. The committee does not have legal or administrative power. It is intended that the committee consider what may be called "quasipolitical" motions. The committee has several possible courses of action on a proposed motion, including but not restricted to:

- (a) doing nothing,
- (b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting,
- (c) recommending and planning a format for debate to suggest to a Business Meeting,
- (d) recommending referral to a committee, and
- (e) recommending debate followed by referral to a committee.

There is no mechanism that requires automatic submission of a motion to the committee. However, if a motion has not been submitted through the committee, it may be thought reasonable by a Business Meeting to refer it rather than to act on it without benefit of the advice of the committee.

The committee consists of Carl C. Cowen, Robert M. Fossum (chair), and Rebecca A. Herb.

In order that a motion for the Business Meeting of January 7, 1995, receive the service offered by the committee

in the most effective manner, it should be in the hands of the secretary by December 7, 1994.

**78th Annual Meeting of the MAA
January 4–7, 1995**

Invited Addresses

Lenore Blum, Mathematical Sciences Research Institute, *Computing over the reals*, Saturday 9:00 a.m.;

Joan Ferrini-Mundy, University of New Hampshire, *Research in the teaching and learning of calculus: Progress and potential*, Friday 2:15 p.m.;

David R. Hill and **David E. Zitarelli**, Temple University, *Teaching linear algebra with technology: Its impact*, Wednesday 3:20 p.m.;

Mario U. Martelli, California State University at Fullerton, *Rolle's Theorem: Historical remarks, recent developments, a multidimensional version, and a conjecture*, Saturday 10:05 a.m.;

Karen H. Parshall, University of Virginia, *Applied pure mathematics: The case of J. J. Sylvester and invariant theory*, Thursday 10:05 a.m.; and

Karen Uhlenbeck, University of Texas at Austin, *Geometric perspective in research*, Wednesday 2:15 p.m..

Minicourses

Minicourse #1: *Calculus from graphical, numerical, and symbolic points of view*, **Arnold M. Ostebee** and **Paul Zorn**, St. Olaf College. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 50. Cost is \$45.

Minicourse #2: *Teaching environmental numeracy to liberal arts students*, **Martin E. Walter**, University of Colorado, Boulder. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. Cost is \$45.

Minicourse #3: *Combinatorics via functional equations*, **Donald R. Snow**, Brigham Young University. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. Cost is \$45.

Minicourse #4: *The mathematics of epidemics*, **Sonja I. Sandberg**, Framingham State College. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. Cost is \$45.

Minicourse #5: *An introductory mathematics course called CHANCE*, **J. Laurie Snell**, Dartmouth College; **Peter G. Doyle**, University of California, San Diego; and **Joan B. Garfield**, University of Minnesota, Minneapolis. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 2:15 p.m. to 4:15 p.m. on Wednesday. Enrollment limited to 80. Cost is \$45.

Minicourse #6: *Exploring MathKit microworlds*, **Ladnor D. Geissinger** and **James E. White**, University of North Carolina, Chapel Hill. Part A: 8:00 a.m. to 10:00 a.m. on

Saturday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 30. Cost is \$65.

Minicourse #7: *How to use graphing calculator-based numerical and graphical methods to enhance the teaching and learning of calculus*, **Wade Ellis, Jr.**, West Valley College, and **Bert K. Waits**, The Ohio State University. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 8:00 a.m. to 10:00 a.m. on Thursday. Enrollment limited to 30. Cost is \$45.

Minicourse #8: *Learning styles approach to mathematics instruction*, **Kenneth Williamson** and **Richard M. Schori**, Oregon State University. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 2:15 p.m. to 4:15 p.m. on Thursday. Enrollment limited to 80. Cost is \$45.

Minicourse #9: *Dynamic geometry via Geometer's Sketchpad*, **Doris J. Schattschneider**, Moravian College, and **James R. King**, University of Washington. Part A: 2:15 p.m. to 4:15 p.m. on Wednesday, and Part B: 2:15 p.m. to 4:15 p.m. on Thursday. Enrollment limited to 30. Cost is \$65.

Minicourse #10: *The use of symbolic computation in probability and statistics*, **Zaven A. Karian**, Denison University, and **Elliot A. Tanis**, Hope College. Part A: 8:00 a.m. to 10:00 a.m. on Friday, and Part B: 1:00 p.m. to 3:00 p.m. on Friday. Enrollment limited to 30. Cost is \$65.

Minicourse #11: *Multivariable calculus using the Harvard Calculus Consortium materials*, **Thomas W. Tucker**, Colgate University. Part A: 2:15 p.m. to 4:15 p.m. on Thursday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 50. Cost is \$45.

Minicourse #12: *Linear algebra with DERIVE*, **Jerry A. Johnson**, University of Nevada, Reno, and **Benny D. Evans**, Oklahoma State University. Part A: 7:00 p.m. to 9:00 p.m. on Thursday, and Part B: 7:00 p.m. to 9:00 p.m. on Friday. Enrollment limited to 30. Cost is \$65.

Minicourse #13: *Introduction to research in the teaching and learning of undergraduate mathematics: Examples in calculus*, **Joan Ferrini-Mundy**, University of New Hampshire, and **M. Kathleen Heid**, Pennsylvania State University. Part A: 7:00 p.m. to 9:00 p.m. Thursday, and Part B: 8:00 a.m. to 10:00 a.m. Saturday. Enrollment limited to 30. Cost is \$45.

Minicourse #14: *Recovering motivation in mathematics: Teaching with original sources*, **Reinhard Laubenbacher** and **David J. Pengelley**, New Mexico State University. Part A: 8:00 a.m. to 10:00 a.m. on Friday, and Part B: 1:00 p.m. to 3:00 p.m. on Friday. Enrollment limited to 80. Cost is \$45.

Minicourse #15: *Cooperative groups and Socratic interactions in the college mathematics classroom*, **William J. Davis**, and **Thomas G. Ralley**, The Ohio State University. Part A: 8:00 a.m. to 10:00 a.m. on Friday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 60. Cost is \$45.

Minicourse #16: *How to make fractals*, **Denny Gulick**, University of Maryland, and **Jon W. Scott**, Montgomery College. Part A: 8:00 a.m. to 10:00 a.m. on Friday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 40. Cost is \$45.

Minicourse #17: *An introduction to numerical modeling*,

John P. Loase, Westchester Community College, and **Ben A. Fusaro**, Salisbury State University. Part A: 1:00 p.m. to 3:00 p.m. on Friday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. Cost is \$45.

Minicourse #18: *Calculus in context*, **James J. Callahan**, Smith College, **Kenneth R. Hoffman**, Hampshire College, **Donal B. O'Shea**, Mount Holyoke College, and **Harriet Pollatsek**, Mount Holyoke College. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 8:00 a.m. to 10:00 a.m. on Thursday. Enrollment limited to 30. Cost is \$65.

Minicourse #19: *An introduction to fractal functions and fractal surfaces and their connection to wavelet theory*, **Peter R. Massopust**, Sam Houston State University. Part A: 7:00 p.m. to 9:00 p.m. on Friday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. Cost is \$45.

Minicourse #20: *Doing discrete mathematics with undergraduates*, **Gary J. Sherman**, Rose-Hulman Institute of Technology. Part A: 8:00 a.m. to 10:00 a.m. on Saturday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. Cost is \$45.

Minicourse #21: *Mathematical modeling*, **Mark M. Meerschaert**, University of Nevada, Reno. Part A: 7:00 p.m. to 9:00 p.m. on Friday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. Cost is \$45.

Minicourse #22: *Learning about today's job market for mathematics Ph.D.s*, **Curtis D. Bennett**, Bowling Green State University, and **Richard E. Phillips**, Michigan State University. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. Cost is \$20.

Participants interested in attending should complete the MAA Minicourse Advance Registration Form found at the back of this issue and **send it with payment directly to the MAA office** so as to arrive prior to the November 16 deadline. To check on availability for on-site registration after the deadline, potential participants are encouraged to call the MAA headquarters at 800-331-1622. The MAA reserves the right to cancel any Minicourse which is undersubscribed. Should this occur, those registered in advance will be notified and will receive a full refund.

Because of the popularity of the Minicourse program and the number of courses available for this meeting, the MAA is offering five courses on Tuesday, one day prior to the opening session. Since attendance at these courses will require advanced planning, individuals wishing to be enrolled in Minicourses #1–4 or #22 should register in advance. Potential participants who do not register in advance for a Minicourse held on Tuesday may find it impossible to register for the course of their choice on site.

The MAA Minicourses are open only to persons who register for the Joint Meetings and pay the Joint Meetings registration fee. **If the only reason for registering for the Joint Meetings is to gain admission to a Minicourse, this should be indicated by checking the appropriate box on the MAA Minicourse Advance Registration Form.** Then, if the is fully subscribed, a full refund will be made of the

Joint Meetings advance registration fee (otherwise subject to the 50% rule).

Contributed Paper Sessions

Teaching with original sources, **Reinhard Laubenbacher** and **David J. Pengelley**, New Mexico State University; 8:00 a.m. and 3:20 p.m. on Wednesday and 2:15 p.m. on Thursday.

Laboratory approaches to teaching mathematics, **Jon Wilkin**, Northern Virginia Community College, and **Marilyn E. Mays**, North Lake College; 8:00 a.m. on Wednesday and 7:00 p.m. on Thursday. Sponsored by the Committee on Two-Year Colleges.

New directions in student assessment, **Rose C. Hamm**, College of Charleston, and **Richard A. Vandervelde**, Hope College; 8:00 a.m. on Wednesday and 7:00 p.m. on Thursday. Sponsored by the Committee on Testing.

Chaotic dynamics and fractal geometry, **Denny Gulick**, University of Maryland, and **Jon W. Scott**, Montgomery College; 2:15 p.m. on Wednesday and 1:00 p.m. on Friday.

Innovations in teaching linear algebra, **Donald R. LaTorre**, Clemson University; **Steven J. Leon** (ATLAST), University of Massachusetts at Dartmouth; **David C. Lay** (LACSG), University of Maryland; 2:15 p.m. on Wednesday, 7:00 p.m. on Thursday, and 1:00 p.m. on Friday.

Preparing teachers to implement change, **Bettye M. Clark**, Clark Atlanta University; **Robert A. Bix**, University of Michigan-Flint; and **M. Kathleen Heid**, Pennsylvania State University; 2:15 p.m. on Wednesday and 8:00 a.m. on Friday. Sponsored by the Committee on the Mathematical Preparation of Teachers.

Dynamic geometry, **James R. King**, University of Washington, and **Doris J. Schattschneider**, Moravian College; 8:00 a.m. on Thursday and 8:00 a.m. on Saturday. Sponsored by the Committee on Computers in Mathematics Education.

The first two years, **William J. Davis**, The Ohio State University, and **Donald B. Small**, U.S. Military Academy; 8:00 a.m. on Thursday and 8:00 a.m. on Saturday. Sponsored by the CUPM Subcommittee on Calculus Reform and the First Two Years.

Recruitment and retention of women faculty, **Marcelle Bessman**, Frostburg State University; **Gerald J. Porter**, University of Pennsylvania; and **Sr. Miriam P. Cooney**, University of Notre Dame; 2:15 p.m. on Thursday and 8:00 a.m. on Friday. Sponsored by the Committee on Women in the Mathematical Sciences.

Experiences with modeling in elementary differential equations, **Robert L. Borrelli**, Harvey Mudd College, and **Courtney S. Coleman**, Harvey Mudd College; 8:00 a.m. and 1:00 p.m. on Saturday.

Making statistics come alive, **Robert W. Hayden**, Plymouth State College, and **Mary R. Parker**, Austin (Texas) Community College; 8:00 a.m. on Thursday and 7:00 p.m. on Friday.

Mathematical sciences, technology, and economic competitiveness, **S. Brent Morris**, National Security Agency, and **Patrick Dale McCray**, G. D. Searle and Company; 2:15

p.m. on Thursday and 7:00 p.m. on Friday. Sponsored by the Committee on Mathematicians Outside Academia.

Details on submission procedures were published in the September issue of the *Notices* and the June issue of *FOCUS*. Authors should have submitted summaries of their talks to the organizers by September 2, 1994.

Other MAA Sessions

Life after Retirement: Wednesday, 8:00 a.m. to 8:55 a.m. This panel discussion is organized by **Andrew Sterrett, Jr.**, MAA, and includes **Henry L. Alder**, University of California, Davis; **Barbara J. Beechler**, Pitzer College; **Lester H. Lange**, Moss Landing Marine Laboratories; and **Courtney S. Coleman**, Harvey Mudd College.

Community Service Learning: Wednesday, 8:00 a.m. to 9:20 a.m. This panel discussion is sponsored by the Coordinating Council on Human Resources. The term "community service learning" refers to programs in which community service, often voluntary, by students is used to enrich undergraduate programs. This discussion will emphasize examples and possibilities for community service learning in mathematics. The panel members are **Manuel P. Berriozábal**, University of Texas at San Antonio; **Donald W. Bushaw**, Washington State University; **Sr. Helen Christensen**, Loyola College in Maryland; **Eileen L. Poiani**, St. Peter's College; and **Uri Treisman**, University of Texas at Austin.

Mathematical Competitions: Bringing Out the Best?: Wednesday, 8:00 a.m. to 9:55 a.m. Organized by **Thomas W. Tucker**, Colgate University. The MAA and NCTM have established a task force to study issues surrounding the various mathematical competitions presently offered, particularly for grades six through twelve. The panel, made up partly of members of this task force, will address a number of matters: the underrepresentation of women and minorities, individual versus team competitions, alternative project-oriented competitions like the COMAP Modeling Contest, and regional contests.

Institutional Approach to Calculus Reform—Getting Everyone on Board: Wednesday, 9:05 a.m. to 10:55 a.m. There's more to change at the department level than adopting a textbook or technology. Articulating goals and objectives, considering alternative methods to realize them, choosing new or renewed themes, topics and applications, preparing for student responses to assignments that do not conform to expectations, recognizing resource needs and limitations, and paying attention to other interested groups (client disciplines, the administration, etc.)—all are part of the planning that will be discussed by participants (**Mark Bridger**, Northeastern University; **Morton Brown**, University of Michigan; and others) in this presentation chaired by **Martin E. Flashman**, Humboldt State University. Sponsored by the CUPM Subcommittee on Calculus Reform and the First Two Years.

SUMMA Special Presentation: Wednesday, 9:05 a.m. to 10:55 a.m. This presentation on intervention projects for minority pre-college students is being organized by **William A. Hawkins**, director of SUMMA (Strengthening Under-

represented Minority Mathematics Achievement). Presenters include **James A. Donaldson**, Howard University; **Eunice L. Krinsky**, California State University at Dominguez Hills; and **Jack Y. Narayan**, SUNY at Oswego. There will be ample time for questions.

Presentations by ILI Awardees: Wednesday, 9:05 a.m. to 10:55 a.m. This session provides opportunity for recent awardees in the NSF Instrumentation and Laboratory Improvement-Leadership in Laboratory Development initiative to describe their projects. Selected projects will be highlighted. Organized by **Anita E. Solow**, Grinnell College, as part of the NSF-funded MAA project, Priming the Pump for Curricular Reform.

Forum on the Mathematical Preparation of K-6 Teachers: Thursday, 8:00 a.m. to 9:20 a.m. Organized by **Susan L. Forman** and **Lynn A. Steen**, Mathematical Sciences Education Board (MSEB). Panelists will present findings and recommendations contained in a paper prepared at the request of the leadership of AMATYC, AMS, MAA, NCTM and SIAM. The paper, available from the MSEB, reflects the experiences and expertise of mathematicians and mathematics educators and outlines an agenda for action by the societies. The purpose of the session is to gather feedback for the societies on the recommended actions.

The Emerging Scholars Programs: Strengthening Freshman Mathematics Courses to Achieve Diversity: Thursday, 9:30 a.m. to 10:55 a.m. Sponsored by the Committee on Mathematical Preparation of Minorities and organized by **Uri Treisman**, University of Texas at Austin. A panel of presenters will discuss their departments' successful efforts to attract an increasingly diverse group of well-prepared men and women to the mathematics major and to graduate study in mathematics and closely related fields.

Mathematical Preparation of the Technical Work Force: Thursday, 9:30 a.m. to 10:55 a.m. Three out of four workers do not have bachelor's degrees. Yet many of them use mathematics on their jobs. What role can AMS and MAA members play in influencing changes in the mathematics curriculum in response to the growing demand for technically skilled workers? Panel members will outline issues in the school-to-work movement, e.g., standards, articulation between secondary and postsecondary education, and tracking. Panelists include **Jack Price**, National Council of Teachers of Mathematics; **Lynn A. Steen**, MSEB; and **Susan L. Forman**, MSEB.

Advising Methods that Work: Thursday, 2:15 p.m. to 4:10 p.m. Organized by **Diane L. Herrmann**, University of Chicago, and **David J. Lutzer**, College of William and Mary. Panelists **Judith N. Cederberg**, St. Olaf College; **Andrew Sterrett, Jr.**, MAA; **Stephen A. Doblin**, University of Southern Mississippi, and the organizers will discuss such topics as a successful mathematics placement model for first-year students, nationally available career-advising materials, graduate school advising, and development of departmental-advising handbooks.

Popularizing Mathematics: Thursday, 2:15 p.m. to 4:10 p.m. Mathematics has difficulty in attracting positive attention

from the public and the press. There appears to be increasing activity by mathematicians in various media (TV, newspaper, etc.) and using various situations (Math in the Mall, Math Awareness Week, etc.). This panel will focus on the popularization of mathematics as it aims to change attitudes rather than on its role of teaching mathematics content. Organized by **Eric R. Muller**, Brock University, and **Bernard R. Hodgson**, Université Laval. The panel will consist of **Keith J. Devlin**, St. Mary's College of California; **Katherine Heinrich**, Simon Fraser University; **Lynn A. Steen**, MSEB; and **Virginia Thompson**, University of California at Berkeley.

Testing Issues with Technology: Thursday, 2:15 p.m. to 4:10 p.m. This panel will be moderated by **John Harvey**, University of Wisconsin, Madison. Opening comments by the panel members will be followed by questions, comments, and discussion with the audience. Likely questions are: When should calculators be allowed on tests? What about testing when students use CAS? What kinds of questions are no longer reasonable when testing with technology? What are good questions when testing with technology? What is the role of pencil and paper computation in testing today? Panelists are **Philip C. Curtis**, UCLA; **Linda H. Boyd**, DeKalb College; **Bert K. Waits**, the Ohio State University; **Wade Ellis**, West Valley College; and the moderator. Sponsored by the Committee on Testing.

Reunion for Calculus Reform Workshop Participants: Thursday, 7:00 p.m. to 8:20 p.m. This session is for participants in these workshops but is open to all. Organized by **Donald B. Small**, U. S. Military Academy.

Humanistic Mathematics Network: Thursday, 7:00 p.m. to 8:20 p.m. The Network invites all who want to present a topic appropriate to humanistic mathematics to do so. For convenience of scheduling, it would be helpful to contact the organizer, **Alvin M. White**, Harvey Mudd College

Poetry Reading: Thursday, 8:30 p.m. to 9:30 p.m. All poets and other interested persons are invited to come and read their own verse on mathematics or work by another author. Advance registration is not necessary, but it would be helpful to know that you plan to read. To indicate your interest or to obtain more information, please contact the organizer, **JoAnne S. Growney**, Bloomsburg University.

Standards for Introductory College Mathematics: Friday, 8:00 a.m. to 9:20 a.m. The final circulating draft of Standards for Introductory College Mathematics (released fall 1994) will be discussed. Copies of this document—produced by AMATYC with representation from AMS, MAA, NCTM, and the National Association of Developmental Education—will be available at the door. Moderated by the project director, **Marilyn E. Mays**, North Lake College, a panel consisting of **Donald R. Cohen**, SUNY at Cobleskill; **Karen T. Sharp**, Mott Community College; **Stephen B. Rodi**, Austin Community College; **James R. C. Leitzel**, University of Nebraska-Lincoln; **Linda H. Boyd**, DeKalb College; and **Gregory D. Foley**, Sam Houston State University, will answer questions and respond to comments.

Preparation of Beginning Graduate Student Teaching Assistants: Friday, 8:00 a.m. to 9:20 a.m. It is not uncommon

for departments of mathematics to employ beginning graduate students to assist in first- and second-year undergraduate mathematics courses, in some cases delegating to the graduate student complete responsibility for teaching one of many small sections of the course. This panel, organized by **Lee L. Zia**, University of New Hampshire, will examine programs that departments can (and should) conduct to help prepare new graduate students for this responsibility and to support their efforts. Panelists will include **Edward K. Hinson**, University of New Hampshire; **Deborah Hughes-Hallett**, Harvard University; **Daniel J. Madden**, University of Arizona; and **Patricia D. Shure**, University of Michigan.

Reform in Engineering Curricula: Friday, 9:30 a.m. to 10:55 a.m. What's happening in engineering curricula? **De-lore's Etter**, professor of electrical and computer engineering at the University of Colorado at Boulder, will talk about the substantial changes under way in engineering education, with special emphasis on what is being done in the numerous engineering coalitions funded by NSF in recent years. Over eighty engineering programs in the U.S. are now involved in these coalitions, and each is focusing on reform of some aspect of engineering curricula. Following her talk there will be time for questions and discussion of how these changes might impact mathematics courses. This special presentation is sponsored by the CUPM Subcommittee on Service Courses and is organized by **Jane M. Day** (chair), San Jose State University, and **Wade Ellis**, West Valley College.

The Information Superhighway and You: Friday, 1:00 p.m. to 3:30 p.m. What is the information superhighway? Why should I care? Experts from the computer, communications, and information database industries as well as academe will address these and related questions in this panel session. Sponsored by the Committee on Computers in Mathematics Education and the Committee on Electronic Services. The organizers are **Arnold M. Ostebee** (moderator), St. Olaf College, and **Donald J. Albers**, MAA; the panelists are **Tom Davis**, Silicon Graphics; **R.W. Lucky**, Bellcore; and **Jay M. Tenenbaum**, Enterprise Integration Technologies.

Open Forum: Discussion of the CTUM/CUPM Agenda: Friday, 1:00 p.m. to 3:30 p.m. Enhancing the undergraduate mathematics program is currently a focus of discussion in the mathematical community. Issues of HOW we teach are inextricably bound with issues of WHAT we teach. These discussions have implications for the agendas of MAA's Committee on the Undergraduate Program in Mathematics and the Committee on the Teaching of Undergraduate Mathematics; this session will provide the mathematics community an opportunity to suggest issues and directions for future work. The chair of these committees, **James R. C. Leitzel**, University of Nebraska-Lincoln, will moderate the session, and other members of the committees will also be present for reaction and response.

MAA Teaching Awards Presentations: Friday, 3:20 p.m. to 5:00 p.m. Each winner of the MAA Awards for Distinguished College or University Teaching of Mathematics will make a presentation on "the secrets of their success".

Informal Session on Actuarial Education: Friday, 5:05

p.m. to 6:20 p.m. Organized for the Actuarial Faculty Forum by **James W. Daniel**, University of Texas at Austin. Refreshments will be available.

Assessing Calculus Reform Efforts—A Report to the Community: Saturday, 8:00 a.m. to 9:00 a.m. With support from the National Science Foundation (NSF), the Mathematical Association of America (MAA) conducted an assessment of the nationwide calculus reform effort. The task was to get an indication of the current involvement of mathematical sciences departments (their faculty and students) in efforts to revise courses in calculus. The project did not attempt to assess outcomes of individual projects, but tried to provide a report on the movement as a whole. This session reports the findings. A limited number of copies of the report will be available. Presenters include **Alan C. Tucker**, State University of New York, Stony Brook; **John A. Dossey**, Illinois State University; and **James R. C. Leitzel**, University of Nebraska-Lincoln.

Classroom Climate Scenarios: What Would You Do if...?: Saturday, 9:30 a.m. to 10:55 a.m. Organized by **Deborah Tepper Haimo**, University of California, San Diego, with assistance from **Daniel L. Goroff**, Harvard University, this session will present three or four general and subtle scenarios which might arise to make the classroom situation uncomfortable for some; a panel of six will respond to questions posed by Goroff and the audience.

Shaping Up: Expectations for High School Mathematics: Saturday, 1:00 p.m. to 2:55 p.m. This session, organized by **Susan Forman**, MSEB, **Donald L. Kreider**, Dartmouth College, and **Marcia P. Sward**, MAA, is sponsored by the Coordinating Board for AMATYC, MAA, and NCTM (CBAMN). Representatives from the CBAMN societies will be joined by representatives from AMS, MSEB, and SIAM to present examples of the kinds of mathematical tasks students need to be able to perform when they exit high school, regardless of whether they are headed for jobs, technical education programs, or college. The problems will present innovative approaches to assessing student learning of significant mathematics. Discussion will focus on the reasons the examples were selected, the implications for college mathematics and the suitability of the assessment strategies.

Undergraduate Curriculum Reform: Saturday, 1:00 p.m. to 4:30 p.m. In addition to projects directed toward changes in the teaching and learning of calculus, there are programs addressing change in other areas of the undergraduate mathematics curriculum. This session highlights some of these projects that were recently funded through NSF's program in Undergraduate Course and Curriculum Development. Organized by **James R. C. Leitzel**, University of Nebraska-Lincoln, as part of the NSF-funded MAA project, *Priming the Pump for Curricular Reform*.

Panel Discussion by Industry Actuaries: How to Help Your Students Prepare for and Find Jobs: Saturday, 3:00 p.m. to 4:30 p.m. Organized for the Actuarial Faculty Forum by **James W. Daniel**, University of Texas at Austin.

Other MAA Events

Board of Governors: Tuesday, 8:30 a.m. to 4:00 p.m., open to all members of the Association.

Section Officers: Wednesday, 4:30 p.m. to 6:30 p.m.

Two-Year College Reception: The Committee on Two-Year Colleges is sponsoring an informal reception for two-year college faculty and their friends from 5:45 p.m. to 7:00 p.m. on Thursday.

Business Meeting: Saturday, 11:10 a.m. to 11:40 a.m., open to all members of the Association.

Student Activities

Joint Pi Mu Epsilon and MAA Student Chapters Advisors Continental Breakfast: Friday, 7:00 a.m. to 8:00 a.m.; the contact person is **Aparna Higgins**, University of Dayton.

Student Chapters Paper Session: Friday, 8:00 a.m. to 10:55 a.m. This session serves as a forum for the exchange of ideas among advisors to individual chapters and Section coordinators. Each fifteen-minute talk will focus on one or several activities implemented by a campus chapter or by a section or on activities supported by the Exxon grants. Sponsored by the Committee on Student Chapters and organized by **Karen J. Schroeder**, Bentley College.

Student Lecture: *Newton's (Original) Method—or—Though this be method, yet there is madness in't*, **William Dunham**, Muhlenberg College, 7:30 p.m. on Friday, sponsored by the Committee on Student Chapters. The talk will be followed by an ice cream social.

Student Workshop on Mathematics and the AIDS Epidemic: This workshop, intended only for students, is scheduled from 1:00 p.m. to 3:00 p.m. on Saturday and is organized by **Sonja I. Sandberg**, Framingham State College. Since the first cases of AIDS in the U.S. were identified in California in 1981, much scientific research has been conducted in order to understand the spread of this infection, to develop successful treatments, and to discover a vaccine for prevention. Many areas of mathematics, including probability, differential equations, and numerical methods, have important roles to play in modeling the AIDS epidemic and predicting its outcome. In this workshop several aspects of quantitative research on AIDS will be explored by considering the following questions: Is it good public health policy to mandate premarital screening for HIV? How can we project the expected number of future AIDS cases? How can we predict the impact of various interventions, such as changes in behavior or the introduction of an "imperfect" vaccine? How can we model an individual's risk of acquiring an HIV infection?

MAA Student Chapter Hospitality/Information Center: The MAA Committee on Student Chapters is sponsoring a hospitality/information center which will be open from Wednesday morning until 3:00 p.m. on Saturday during the open hours of the Joint Meetings Registration Desk. The center will serve as a gathering place for all students who are attending the Joint Meetings.

Activities of Other Organizations

Association for Symbolic Logic (ASL)

All sessions will take place on Friday and Saturday in the Holiday Inn Goldengate.

Invited Speakers: (days and times to be announced)

Tomek Bartoszyński, Boise State University, *Title to be announced*;

Valentina S. Harizanov, George Washington University, *Recursive model theory: Examining computability in the theory of theories*;

Alexander S. Kechris, California Institute of Technology, *Title to be announced*;

Steffen Lempp, University of Wisconsin, Madison, *Title to be announced*;

Alexandra V. Shlapentokh, East Carolina University, *Algebraic and Turing separability of rings*; and

Theodore A. Slaman, University of Chicago, *Title to be announced*.

Contributed Papers: Abstracts of contributed papers from ASL members should be sent by the deadline of **October 21, 1994**, to the program chair, **Andreas Blass**, Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48109; e-mail: Andreas.Blass@math.lsa.umich.edu.

Association for Women in Mathematics (AWM)

Sixteenth Annual Emmy Noether Lecture: **Judith D. Sally**, Northwestern University, 9:00 a.m. on Thursday. (A dinner in her honor is described in the *Social Events* section of this announcement.)

Panel Discussion: Wednesday, 3:20 p.m.

Business Meeting: Wednesday, 4:20 p.m.

Open Reception: Wednesday, 9:30 p.m. See the *Social Events* section for details.

Workshop: Saturday, 9:00 a.m. to 5:00 p.m. With funding from the National Science Foundation and the Office of Naval Research AWM will conduct its workshop for women graduate students and women who have received the Ph.D. within the last five years.

There will be funding for travel and subsistence for up to ten women graduate students and ten women beyond the Ph.D. to participate in the workshop. Participants will have the opportunity to present and discuss their research and to meet with other women mathematicians at all stages of their careers. The workshop will also include a panel discussion on issues of career development and a luncheon. All mathematicians (female and male) are invited to attend the entire program even though only twenty women will be funded. Departments are urged to help graduate students and postdocs obtain some institutional support to attend the workshop and the meetings.

To be eligible for funding, graduate students must have begun work on a thesis problem. All non-U.S. citizens must have a current U.S. address. Each application should include a curriculum vitae and a concise description of research; a graduate student applicant should include a letter of recommendation from her thesis advisor.

All applications must be received by **October 15, 1994**. Please send **five** copies of the application materials to: Workshop Selection Committee, Association for Women in Mathematics, 4114 Computer and Space Sciences Building, University of Maryland, College Park, MD 20742-2461. Inquiries may be made by telephone: 301-405-7892 or e-mail: awm@math.umd.edu.

Joint Policy Board for Mathematics (JPBM) Committee on Professional Recognition and Rewards Discussion: Wednesday, 9:00 a.m. to 10:30 a.m. Discussion of follow-up activities resulting from the report, "Recognition and Rewards in the Mathematical Sciences", including its impact on graduate education. Panelists may include **Ronald G. Douglas**, SUNY at Stony Brook; **Richard H. Herman**, JPBM; and **Calvin C. Moore**, University of California at Berkeley.

Forum on Mathematics Awareness Week: Friday, 9:45 a.m. to 10:45 a.m. All participants are invited to share their MAW activities, ideas, problems, etc., so that JPBM may evaluate the program and learn how to be more responsive to member needs in future planning. Organizers are **Richard H. Herman** and **Kathleen Holmay**, JPBM.

Public Policy Address: Thursday, 11:10 a.m.

Public Information Session: Wednesday, 2:15 p.m. to 3:15 p.m. Mathematicians and representatives from the media will discuss what they wish the public knew about mathematics, what the public may know about mathematics and how they learn it, how to improve the dialogue between mathematicians and the general public, and how to encourage mathematicians with interesting stories to go public with them in various ways. Organizers are **Richard H. Herman** and **Kathleen Holmay**, JPBM.

National Association of Mathematicians (NAM)

Board of Directors Meeting: Thursday, noon to 4:15 p.m.

Presentations by Recent Doctoral Recipients: Friday, 2:15 p.m. to 4:00 p.m.; moderated by **Stella Ashford**, Southern University.

Cox-Talbot Address: Friday, 7:30 p.m. after the banquet.

Panel Discussion: Saturday, 9:00 a.m. to 10:00 a.m. Saturday. *NAM's first quarter of a century: The past, the present, and the future*, moderated by **Mary Hawkins**, Prairie View University, with panelists **John W. Alexander, Jr.**, University of the District of Columbia; **Lee Lorch**, York University; **Rogers J. Newman**, Southern University; and **Janis M. Oldham**, North Carolina A&T State University.

Business Meeting: Saturday, 10:00 a.m. to 10:55 a.m.

William W. S. Claytor Lecture: Saturday, 1:00 p.m.

See the *Social Events* section for details about the banquet.

National Science Foundation (NSF)

Invited Address: Wednesday, 5:05 p.m. to 5:55 p.m.

The NSF will also be represented at a booth in the exhibit area. NSF staff members will be available to provide counsel and information on NSF programs of interest to

mathematicians. The booth is open the same days and hours as the exhibits. Times that staff will be available will be posted at the booth.

Rocky Mountain Mathematics Consortium (RMMC) Board of Directors Meeting: Friday, 2:15 p.m. to 4:10 p.m.

Young Mathematicians Network (YMN) Concerns of Young Mathematicians: A Town Meeting: Saturday, 1:00 p.m. to 2:00 p.m. Representatives from YMN will discuss the problems in the job market with input from all segments of the mathematics community.

Other Events of Interest

AMS Information Booth: All meeting participants are invited to visit the AMS Information Booth during the meetings. Complimentary coffee and tea will be served. A special gift will be available for participants, compliments of the AMS. The membership manager of the Society will be at the booth to answer questions about membership in the Society.

Book Sales and Exhibits: All participants are encouraged to visit the book, educational media, and software exhibits from 1:00 p.m. to 5:00 p.m. on Wednesday, 9:00 a.m. to 5:00 p.m. on Thursday and Friday, and 9:00 a.m. to noon on Saturday. Books published by the AMS and MAA will be sold at discounted prices somewhat below the cost for the same books purchased by mail. **These discounts will be available only to registered participants wearing the official meetings badge.** VISA and MasterCard will be accepted for book sale purchases at the meeting. Also, AMS electronic products and e-MATH will be demonstrated. Participants visiting the exhibits will be asked to display their meeting badge or acknowledgment of advance registration from the Mathematics Meetings Service Bureau in order to enter the exhibit area.

Mathematical Sciences Employment Register: Those wishing to participate in the San Francisco Employment Register should read carefully the important article about the Register which follows this meeting announcement.

Social Events

It is strongly recommended that tickets for these events be purchased through advance registration, since only a very limited number of tickets, if any, will be available for sale on site. To get a 50% refund, returned tickets must be received by the Mathematics Meetings Service Bureau **by December 23**. After that date no refunds can be made. Special meals are available at all banquets upon advance request, but this must be indicated on the Advance Registration/Housing Form.

Museum Tour: On Wednesday afternoon there will be a tour of the M. H. DeYoung Museum and the Asian Art Museum of San Francisco. Both museums are located in the heart of Golden Gate Park. The DeYoung Museum is noted for its stellar collection of American art. Works spanning 6,000 years from more than three dozen countries comprise the collection of the Asian Art Museum, one of the finest outside

of Asia. Special tours will be conducted of both collections with time for individual browsing or visiting the gift shops. The tour leaves from the Hilton main lobby at 12:30 p.m. and returns no later than 5:00 p.m. Should this tour not reach a minimum of 30, it will be canceled and full refunds issued. The cost is \$26, including transportation and all admissions.

AWM: There is an **open reception** on Wednesday evening at 9:30 p.m. This has been a popular, well-attended event in the past.

All participants are invited to a **dinner to honor AWM's Noether Lecturer, Judith D. Sally**, on Wednesday. A sign-up sheet for those interested will be located at the AWM table in the exhibit area and also at the AWM panel discussion.

MER Banquet: The Mathematicians and Education Reform (MER) Network welcomes all mathematicians who are interested in issues in precollege and undergraduate mathematics education to attend the MER Banquet on Wednesday at 6:30 p.m. This is an opportunity to make or renew ties with other mathematicians who are involved in educational projects. There will be a presentation highlighting the current activities and future plans of the MER Network. There will be a cash bar beginning at 6:30 p.m. Dinner will be served at 7:30 p.m.; the entrée is chicken breast baked with garlic and herbs. Tickets are \$45 each, including tax and gratuity.

NAM Banquet: The National Association of Mathematicians will host a banquet on Friday evening. A cash bar reception will be held at 5:30 p.m., and dinner will be served at 6:00 p.m. The entrée is sautéed breast of chicken. Tickets are \$40 each, including tax and gratuity.

AMS Banquet: As a fitting culmination to the meeting this banquet provides an excellent opportunity to socialize with fellow participants in a relaxed atmosphere. The attendee(s) who has(have) been a member of the Society for the greatest number of years will be recognized and will receive a special award. The banquet will be held on Saturday with a cash bar reception at 6:30 p.m. and dinner at 7:30 p.m. Special door prizes will be travel gift certificates ranging in value from \$100 to \$250. Each attendee will receive a memento of the occasion. The entrée is breast of sliced roast turkey with herb dressing. Tickets are \$40 each, including tax and gratuity.

Registering in Advance and Hotel Accommodations

How to Register in Advance

The importance of advance registration cannot be overemphasized. Advance registration fees are considerably lower than the fees that will be charged for registration at the meeting. Participants who **register by November 9** may elect to receive their programs, badges, and any tickets for social events through the mail before the meeting.

Joint Mathematics Meetings

Member of AMS, ASL, Canadian Mathematical Society, MAA	\$130
Temporarily Employed	95
Emeritus Member of AMS, MAA; Graduate Students; Unemployed; Librarians; High School Teachers	
Third-World Country Participant	35
Undergraduate Students	20
Nonmember	202
High School Students	2

Employment Register

Employer	\$150
Additional Interviewer (each)	75
Applicant	35
Employer Posting Fee	50

AMS Short Course

Students/Unemployed	\$ 30
Emeritus Members of AMS, MAA	30
All Other Participants	75

MAA Minicourses

Minicourse #22	\$ 20
Minicourses #1, 2, 3, 4, 5, 7, 8, 11, 13, 14, 15, 16, 17, 19, 20, 21	45
Minicourses #6, 9, 10, 12, 18	65

- **Full-time Students:** Those currently working toward a degree or diploma. Students are asked to determine whether their status can be described as graduate (working toward a degree beyond the bachelor's), undergraduate (working toward a bachelor's degree), or high school (working toward a high school diploma) and mark the Advance Registration/Housing Form.
- **Emeritus:** Persons who qualify for emeritus membership in either the Society or the Association. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more and is retired because of age or long-term disability from his or her latest position.
- **Librarian:** Any librarian who is not a professional mathematician.
- **Unemployed:** Any person currently unemployed, actively seeking employment, and not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.
- **Third-World Country Participant:** Those from the third world where salary levels are radically noncommensurate with those in the U.S.
- **Temporarily Employed:** Any person currently employed but who will become unemployed by June 1, 1995, and who is actively seeking employment.

Note: Those registering at the **nonmember** rate will receive mailings from AMS and MAA after the meeting is over containing information about a special membership offer.

How to Obtain Hotel Accommodations

The following participants received complimentary hotel rooms during the Cincinnati meetings. They qualified for lottery rooms, which can be occupied by as many as four persons, by submitting their Advance Registration/Hotel (ARH) Form (located at the end of this issue) by the EARLY deadline. Participants wishing to qualify for the San Francisco room lottery are urged to register by the EARLY deadline of November 9. The winners in 1994 were:

Omni Netherland:	Joseph Conrad, Dalton Tarwater, Sarah Witherspoon
Clarion:	Stanley Benkoski, James Bradford, Virginia Buchanan, Andrew Odlyzko, Howard Penn, Marie Postner, Sanjay Rajpal, Catherine Roberts, Alicia Sevilla, Kevin Strobel, Huseyin Tuncali
Westin:	Theresa Early, Joan Garfield, Howard Krehbiel, James Kulich, Richard Laugesen, James Sandefur, David Skoug
Terrace Hilton:	Melvyn Jeter, Stephen Spielberg
Quality Hotel Riverview:	Nezam Iraniparast, Edmond Nadler
Holiday Inn Queensgate:	Zahbiollah Azardi, James Hartman, Edwin Hoefler
Holiday Inn Riverfront:	Jeffrey Anderson, Hai Dinh Dang, Shanshuang Yang

The AMS-MAA Joint Meetings Committee always endeavors to obtain the lowest possible hotel sleeping room rates for participants at annual meetings. The committee is also responsible for maintaining a sound fiscal position for these meetings. As the meetings have grown in scope, the committee has arranged for all of the hotels to collect an extra \$3 per room per night from participants, which will be used to offset the general meeting's expenses. Rates below include this charge.

Participants must register in advance in order to obtain hotel accommodations through the Mathematics Meetings Service Bureau (MMSB). Be sure to complete the Housing section of the ARH Form completely, listing all hotels in order of preference, to insure accurate hotel assignments. Participants are urged to call the hotels directly for details on suite configurations, sizes, etc.; however, reservations for regular sleeping rooms and suites must be made through the MMSB to receive the convention rates listed on the following pages. The MMSB encourages participants to call them at 401-455-4143 or 401-455-4144 for assistance, if necessary.

Rates:

- hotels are listed on the following pages by descending order of single room rates
- subject to a 12% sales/occupancy tax
- parking rates are per day rates
- only certified students or unemployed mathematicians qualify for listed student rates

Deadlines:

- reservations through MMSB: November 16
- hotel will not accept direct reservations
- changes/cancellations through MMSB: December 1
- changes/cancellations through hotels: after December 15
- reservations through hotels: after December 15 (convention rates based on availability only)

Special Services:

- all hotels are working towards being in compliance with the Americans with Disabilities Act (ADA)
- special needs should be clearly indicated on ARH form

Room Payments/Cancellations:

- all major credit cards
- personal checks with personal ID and/or credit card backup
- 72-hour cancellation policy

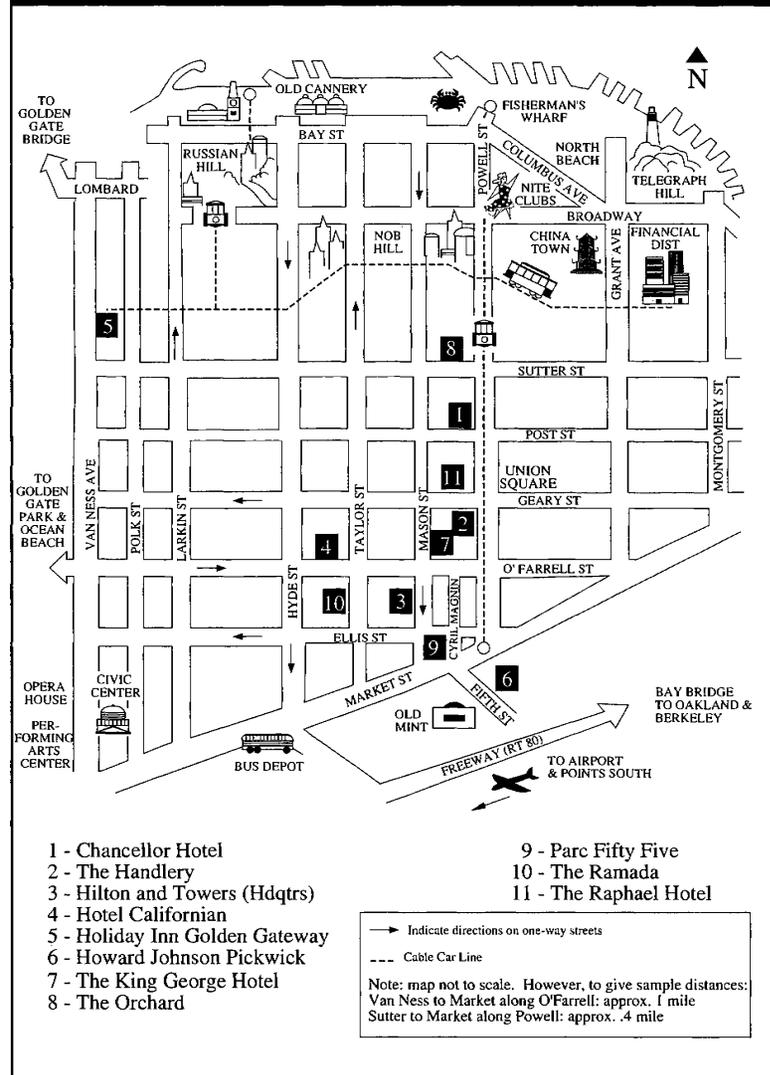
Guarantee Requirements:

- one night deposit by check
- credit card: VISA, MC, AMEX (cards may be charged one night's deposit)

Hotels Info:

- children free at different ages, in existing beds only
- limited nonsmoking rooms (none in King George)
- check in: 3 p.m. / check out: noon
- rooms with windows that open (Parc Fifty Five: fresh air vents)

Downtown San Francisco



How to Obtain Hotel Accommodations (continued)

Hotel Name (Distance from Hilton)	Location	Description	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites (starting rates)
San Francisco Hilton and Towers (Headquarters)	333 O'Farrell Street San Francisco, CA 94102 415-771-1400	Restaurants, Health Club, Sauna, Heated Outdoor Pool, Parking \$22 (In/Out - Self or Valet). All children free								
DELUXE			\$ 115	\$ 128	\$ 128	\$ 148	N/A	\$ 168	N/A	\$ 300
SUPERIOR			103	115	115	135	N/A	155	N/A	300
STANDARD - REGULAR			90	102	102	123	N/A	143	N/A	300
STANDARD - STUDENT OR UNEMPLOYED			78	78	78	N/A	N/A	N/A	N/A	300
The Parc Fifty Five (across the street)	55 Cyril Magnin Street San Francisco, CA 94102 415-392-8000	Restaurant, Lounge, Health Club, Exercise Room, Parking \$23 (In/Out), Children under 18 yrs. free	92	92	92	107	\$ 107 (kings only)	122	\$ 122	289
The Handlery Union Square (Main Building) (2 blocks)	351 Geary Street San Francisco, CA 94102 415-781-7800	Restaurant, Heated Outdoor Pool, Parking \$12.50 (In/Out), Children under 15 yrs. free								
REGULAR			83	83	83	93	N/A	103	N/A	153
STUDENT OR UNEMPLOYED			73	73	73	83	N/A	93	N/A	153
Holiday Inn Golden Gateway (ASL sessions) (8 blocks)	1500 Van Ness Avenue San Francisco, CA 94109 415-441-4000	Restaurant, Lounge, Heated Outdoor Pool, Parking \$11 (guests)/\$12 (local) (In/Out), Children under 19 yrs. free								
REGULAR			82	82	82	97	107	112	122	250
STUDENT OR UNEMPLOYED			73	73	73	88	98	103	113	250
The King George Hotel (across the street)	334 Mason Street San Francisco, CA 94102 415-781-5050, 800-288-6005	Restaurant, English High Tea served, Parking \$15.50 - across street (In/Out), Children under 12 yrs. free								
REGULAR			78	78	78	N/A	N/A	N/A	N/A	N/A
STUDENT OR UNEMPLOYED			68	68	68	N/A	N/A	N/A	N/A	N/A
The Orchard (4 blocks)	562 Sutter Street San Francisco, CA 94102-1102 415-433-4434, 800-433-4434	Restaurant, Lounge, Health Club/Pool off premises (1/2 blk.), Parking \$15 (In/Out) - 1/2 block away	78	78	78	88	98	N/A	N/A	175

(CONTINUED ON NEXT PAGE)

How to Obtain Hotel Accommodations (continued)

Hotel Name (Distance from Hilton)	Location	Description	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites (starting rates)
The Raphael (2 blocks)	386 Geary Street San Francisco, CA 94102 415-986-2000, 800-821-5343	Restaurant, Parking around corner \$15.75 (In/Out), Children under 17 yrs. free								
REGULAR			73	78	78	N/A	88*	N/A	N/A	N/A
STUDENT OR UNEMPLOYED			63	73	73	N/A	83*	N/A	N/A	N/A
Chancellor Hotel (3 blocks)	433 Powell Street San Francisco, CA 94102 415-362-2004, 800-428-4748	Restaurant, Lounge, Parking \$16 - nearby garage (In/Out), Children crib age free								
REGULAR			72	72	72	N/A	87	N/A	N/A	N/A
STUDENT OR UNEMPLOYED			62	62	62	N/A	77	N/A	N/A	N/A
Ramada Inn (across the street)	345 Taylor Street San Francisco, CA 94102 415-673-2332, 800-288-9246	Restaurant, Parking on corner - Valet \$15/Self \$12.50 (In/Out), Children under 12 yrs. free								
REGULAR			72	72	72	84	96	N/A	N/A	N/A
STUDENT OR UNEMPLOYED			62	62	62	74	86	N/A	N/A	N/A
Howard Johnson Pickwick (4 blocks)	85 Fifth Street San Francisco, CA 94103 415-421-7500, 800-227-3282	Restaurant, Lounge, Parking \$12 (In/Out) Children under 16 yrs. free								
REGULAR			68	N/A	68	80	92	92	104	179
STUDENT OR UNEMPLOYED			62	N/A	62	74	86	86	98	179
Hotel Californian (across the street)	405 Taylor Street San Francisco, CA 94102 415-885-2500, 800-227-3346	Restaurant, Lounge, Coffee Shop Parking \$14 (In/Out) Children under 12 yrs. free	63	63	63	73	73	83	N/A	93

* There is no rollaway charge for persons under 18 yrs. of age at the Raphael Hotel.

Advance registration and on-site registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show their badge if so requested. Badges are required to enter the exhibit area, to obtain discounts at the AMS and MAA Book Sales, and to cash a check with the Joint Meetings cashier. If a registrant should arrive too late in the day to pick up his/her badge, he/she may show the acknowledgment of advance registration received from the MMSB as proof of registration.

Registration forms received well before the deadline of November 16 which are not accompanied by correct payment will be returned to the participant with a request for resubmission with full payment. This will, of course, delay the processing of any housing request. If time will not allow return of the form, a \$5 charge will be imposed for all invoices prepared when advance registration forms are submitted with insufficient payment. We are sorry, but it is not possible for the MMSB to refund amounts less than \$2.

Participants should check with their tax preparers for applicable deductions for education expenses as they pertain to this meeting.

There is no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently. Please indicate names for guest badges on the Advance Registration/Housing Form located in the back of this issue.

There will be a **list of advance registrants sorted by area of mathematical interest** posted at the meetings. If you wish to be included in this list, please provide the *Mathematical Reviews* classification number of your major area of interest on the Advance Registration/Housing Form. (A list of these numbers appears on the back of the AMS and MAA abstract forms.)

Advance Registration Deadlines

There are three separate advance registration deadlines, each with its own advantages and benefits.

EARLY advance registration (room lottery and materials mailed)	November 9
ORDINARY advance registration (housing but no lottery, no materials mailed)	November 16
FINAL advance registration (no housing, tickets, or inclusion in the <i>Winter Lists</i> for the Employment Register)	December 7

Early Advance Registration: Those who register by the EARLY deadline of November 9 will be included in a drawing to select randomly winners of complimentary hotel rooms in San Francisco. Multiple occupancy is permissible. The location of rooms to be used in this lottery will be based on the number of complimentary rooms available in the various hotels. Therefore, the free room may not necessarily be in the winner's first choice hotel. The winners will be

notified by mail prior to December 31. **So register early!** (See the list of the winners in Cincinnati in the hotel pages.)

Ordinary Advance Registration: Those who register after November 9 and by the ORDINARY deadline of November 16 may use the housing services offered by the MMSB but are not eligible for the room lottery.

Final Advance Registration: Those who register after November 9 and by the FINAL deadline of December 7 must pick up their badges, programs, and any tickets for social events at the meetings. Unfortunately, it is not possible to provide FINAL advance registrants with housing, nor will applicant or employer forms be reproduced in the *Winter Lists* for the Employment Register. **Please note that the December 7 deadline is firm and any forms received after that date will be returned and full refunds issued.**

Electronic Advance Registration: A form and instructions on how to complete it are on the e-MATH Gopher. They may be accessed either by gopher e-math.ams.org if your system has a gopher client or by telnetting to e-math (login and password are both e-MATH) and selecting Gopher from the main menu. Then select Mathematical Sciences Meetings and Conferences from the gopher menu; select Registration Forms from the meeting menu and follow the instructions. Or, you may send a message to meet@math.ams.org requesting the form. A reply will be sent within 24 hours with the electronic form and instructions on how to complete it. **Credit card is the ONLY method of payment which can be accepted for electronic registration.** Forms received through this method will be treated in the same manner as forms received through U.S. mail, and the same deadlines apply. Receipt of the form and payment will be acknowledged by the MMSB.

All advance registrants will receive acknowledgment of payment prior to the meetings.

Those registering by **November 9** will receive their badges, programs, and prepurchased tickets by mail two to three weeks before the meetings, unless they check the appropriate box to the contrary on the Advance Registration/Housing Form. Because of delays that occur in U.S. mail to Canada, it is strongly suggested that advance registrants from Canada choose to pick up their materials at the meeting. There will be a special Registration Assistance desk at the Joint Meetings to assist individuals who either do not receive this mailing or who have a problem with their registration. Please note that a \$3 replacement fee will be charged for programs and badges that are mailed but not taken to San Francisco.

Miscellaneous Information

Audio-Visual Equipment: Standard equipment in all session rooms is one overhead projector and screen. (Invited 50-minute speakers are automatically provided with two overhead projectors.) **Blackboards are not available.** Participants who require audio-visual assistance should come to the Registration Desk.

MAA speakers requiring additional equipment may make written requests for one additional overhead projector/screen,

35mm carousel slide projector, or VHS video cassette recorder with one color monitor. Such requests should be addressed to the MAA associate secretary (Donovan Van Osdol, Department of Mathematics, University of New Hampshire, Durham, NH 03824; e-mail: don.vanosdol@math.unh.edu). These requests should be received by **November 9**. All other speakers requiring additional equipment should contact the audiovisual coordinator for the meetings at the AMS office in Providence at 401-455-4140, or by e-mail at wsd@math.ams.org by **November 9**.

Speakers are cautioned that requests for equipment made at the meeting may not be satisfied because of budgetary restrictions.

Child Care: Many hotels have a list of bonded child care services. Participants should inquire at their hotel and are responsible for making individual arrangements.

A Parent/Child Lounge will be located in the Hilton. This room will be furnished with casual furniture, a crib, a changing area, and a VCR and monitor for viewing videotapes. Tapes appropriate for children can be checked out at the Audio-Visual section of the Registration Desk. Any child using this lounge must be accompanied by a parent (not simply an adult) who must be responsible for supervision of the child. This lounge will be unattended, and parents assume all responsibility for their children. This lounge will be open only during the hours of registration, and all persons must leave the lounge at the close of registration each day.

Information Distribution: Tables are set up in the exhibit area for dissemination of general information of possible interest to the members and for the dissemination of information of a mathematical nature **not** promoting a product or program for sale.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the exhibit area at the Joint Books, Journals, and Promotional Materials exhibit for a fee of \$35 per item. Please contact the Exhibits Manager, MMSB, P.O. Box 6887, Providence, RI 02940, for further details.

Petition Table: At the request of the AMS Committee on Human Rights of Mathematicians, a table will be made available in the exhibit area at which petitions on behalf of named individual mathematicians suffering from human rights violations may be displayed and signed by meetings participants acting in their individual capacities. For details contact the director of meetings in the Providence office at 401-455-4137 or by e-mail at hhd@math.ams.org.

Travel: The San Francisco International Airport is located 14 miles south of the city and served by major airlines.

American Airlines has been selected as the official airlines for this meeting. We strongly urge participants to make use of this special deal if at all possible, since the AMS and MAA can earn complimentary tickets on American. These tickets are used to send meetings' staff (not officers or other staff) to the Joint Mathematics Meetings, thereby keeping the costs of the meeting (and registration fees) down. The following specially negotiated rates are available only for this meeting and exclusively to mathematicians and their

families attending the meetings.

American Airlines is offering 5% off applicable promotional fares or 10% off full fares booked seven days or more in advance of the meeting. These fares apply to the contiguous 48 states, Hawaii, San Juan, and the U.S. Virgin Islands. For reservations you must refer to **Index Star File # S9097**. You may call the airline directly at 800-433-1790 (7:00 a.m.–midnight, Central Standard Time) and use your credit card and the ticket(s) will be mailed to you, or you may have your travel agent book your ticket(s) for you. You may also purchase your ticket(s) from any local American ticket office or at the airport ticket counter.

From San Francisco International Airport there are several shuttle buses going downtown which are available without reservation. Fares generally run between \$9 and \$11. After retrieving your baggage, go up one level and outside to the shuttle van island. Shuttle companies are identified by different color zones. Be sure to call at least 24 hours in advance to arrange pickup from your hotel back to the airport.

Cabs can be hailed from the sidewalk on the carousel level. Approximate cost to the downtown area is between \$27 and \$34.

For Amtrak information call 800-872-7245.

Driving Directions: The San Francisco Hilton on Hilton Square is at Mason between Ellis and O'Farrell. Pedestrians are advised to avoid the Mason Street entrance and exit at Hilton for safety reasons.

SFO Airport to Hilton Hotel: Follow San Francisco signs to U.S. 101 North; continue along 101N, exit Ninth Street ramp. Left turn onto Ninth Street, taking rightmost lane to Market Street. Cross Market Street, make 45-degree turn onto Larkin, 8 blocks to O'Farrell. Right turn onto O'Farrell, 4 1/2 blocks to Hilton (between Taylor & Mason).

San Jose Airport to Hilton: Follow 280N to Millbrae; exit Trousdale ramp. At crossroad, take left branch, then turn right downhill to El Camino. Turn left onto El Camino, one block; turn right onto Millbrae Avenue to clover right (San Francisco), onto U.S. 101 North; continue with instructions above (SFO to Hilton).

Oakland Airport to Hilton: Take Hegenberger Road to U.S. 880W, to 980W, to toll booths (\$1) for San Francisco. Exit Ninth Street ramp, continue on Ninth to Market. Pick up from first paragraph above.

Marin County to Hilton: Follow U.S. 101S to toll booths in San Francisco (\$3). As the road narrows, take the middle lane then take the right fork to take the Lombard Street-Downtown exit. Turn right at the Lombard/Van Ness Avenue intersection, getting into leftmost lane after Broadway for 18 blocks to O'Farrell; turn left onto O'Farrell for 6 1/2 blocks to Hilton (between Taylor & Mason).

Sacramento/Davis to Hilton: U.S. 50W to East Bay, to U.S. 80W Carquinez Bridge (toll-free westbound/\$1 eastbound), to toll plaza (Oakland side). Follow third paragraph above (Oakland Airport to Hilton).

Weather: Normal daily temperatures are between 46°F and 56°F. Call 415-936-1212 for weather information.

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
MONDAY, JANUARY 2		
<p>8:00 a.m.–5:00 p.m. SHORT COURSE REGISTRATION</p> <p>1:00 p.m.–5:30 p.m. SHORT COURSE ON KNOTS AND PHYSICS</p> <p>1:00 p.m.–5:30 p.m. SHORT COURSE ON CODING THEORY</p>		
TUESDAY, JANUARY 3		
<p>8:00 a.m.–Noon SHORT COURSE REGISTRATION</p> <p>9:00 a.m.–5:00 p.m. SHORT COURSE ON CODING THEORY</p> <p>10:45 a.m.–5:00 p.m. SHORT COURSE ON KNOTS AND PHYSICS</p>	<p>8:30 a.m.–4:00 p.m. BOARD OF GOVERNORS MEETING</p>	
<p>3:00 p.m.–7:00 p.m. JOINT MEETINGS REGISTRATION</p>		
	<p>3:00 p.m.–5:00 p.m. MINICOURSES</p> <p>#1: PART A : <i>Calculus from graphical, numerical, and symbolic points of view.</i></p> <p>#22: PART A : <i>Learning about today's job market for mathematics Ph.D.s.</i></p> <p>#2: PART A : <i>Teaching environmental numeracy to liberal arts students.</i></p> <p>#3: PART A : <i>Combinatorics via functional equations.</i></p> <p>#4: PART A : <i>The mathematics of epidemics.</i></p>	

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
TUESDAY (cont'd)		
<p style="text-align: center;">5:30 p.m.–10:00 p.m. MATHCHATS AND GRADUATE STUDENT RECEPTION</p>		
	<p>7:00 p.m.–9:00 p.m. MINICOURSES #1: PART B <i>Calculus from graphical, numerical, and symbolic points of view.</i></p> <p>#22: PART B <i>Learning about today's job market for mathematics Ph.D.s.</i></p> <p>#2: PART B <i>Teaching environmental numeracy to liberal arts students.</i></p> <p>#3: PART B <i>Combinatorics via functional equations.</i></p> <p>#4: PART B <i>The mathematics of epidemics.</i></p>	
WEDNESDAY, JANUARY 4		
<p style="text-align: center;">7:30 a.m.–4:00 p.m. JOINT MEETINGS REGISTRATION</p>		
<p style="text-align: center;">7:30 a.m.–4:00 p.m. EMPLOYMENT REGISTER REGISTRATION</p>		
<p>8:00 a.m.–10:55 a.m. SPECIAL SESSIONS <i>Commutative Noetherian Rings and Modules, I</i></p> <p><i>Model Theory, I</i></p> <p><i>Extremal Riemann Surfaces, I</i></p> <p>8:00 a.m.–10:55 a.m. SESSIONS FOR CONTRIBUTED PAPERS</p>	<p>8:00 a.m.–10:00 a.m. MINICOURSES #18: PART A <i>Calculus in context.</i></p> <p>#5: PART A <i>An introductory mathematics course called CHANCE.</i></p> <p>#7: PART A <i>How to use graphing calculator-based numerical and graphical methods to enhance the teaching and learning of calculus.</i></p> <p>#8: PART A <i>Learning styles approach to mathematics instruction.</i></p>	

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
<p>WEDNESDAY (cont'd)</p>	<p>8:00 a.m.–10:55 a.m. CONTRIBUTED PAPER SESSIONS <i>New Directions in Student Assessment, I</i></p> <p><i>Teaching With Original Sources, I</i></p> <p><i>Laboratory Approaches to Teaching Mathematics, I</i></p> <p>8:00 a.m.–9:20 a.m. COORDINATING COUNCIL ON HUMAN RESOURCES PANEL DISCUSSION <i>Community service learning.</i></p> <p>8:00 a.m.–8:55 a.m. PANEL DISCUSSION <i>Life after retirement.</i></p> <p>8:00 a.m.–9:55 a.m. MAA AND NCTM PANEL DISCUSSION <i>Mathematical competitions: Bringing out the best?</i></p> <p>9:05 a.m.–10:55 a.m. PRIMING THE PUMP FOR CURRICULAR REFORM PROJECT PRESENTATION <i>Instrumentation and Laboratory Improvement awardees presentation.</i></p> <p>9:05 a.m.–10:55 a.m. CUPM SUBCOMMITTEE ON CALCULUS REFORM AND THE FIRST TWO YEARS PANEL DISCUSSION <i>Institutional approach to calculus reform—Getting everyone on board.</i></p> <p>9:05 a.m.–10:55 a.m. SUMMA SPECIAL PRESENTATION <i>Intervention projects for minority precollege students.</i></p>	<p>9:00 a.m.–10:30 a.m. JPBM COMMITTEE ON PROFESSIONAL RECOGNITION AND REWARDS DISCUSSION <i>Recognition and rewards in the mathematical sciences.</i></p>
<p>9:00 a.m.–9:50 a.m. INVITED ADDRESS <i>Solitary waves, tsunamis, and sand bars.</i> Jerry L. Bona</p> <p>9:00 a.m.–10:00 a.m. SPECIAL PRESENTATION <i>Applications of Internet technologies for mathematics.</i></p>		

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
WEDNESDAY (cont'd)		
10:05 a.m.–10:55 a.m. INVITED ADDRESS <i>Complex analytic dynamics in two dimensions.</i> John Smillie		
11:10 a.m.–Noon INVITED ADDRESS <i>The algebra of solving polynomial equations.</i> David A. Cox		
1:00 p.m.–2:00 p.m. COLLOQUIUM LECTURE I <i>Mysteries in three and four dimensions.</i> Clifford Taubes		
1:00 p.m.–5:00 p.m. BOOK SALES AND EXHIBITS		
	2:15 p.m.–3:05 p.m. INVITED ADDRESS <i>Geometric perspective in research.</i> Karen Uhlenbeck	
2:15 p.m.–6:05 p.m. AMS-MAA-MER SPECIAL SESSION <i>Mathematics and Education Reform, I</i>		
2:15 p.m.–6:05 p.m. SPECIAL SESSIONS <i>The Simple Group Classification: Second Generation Proof and Applications, I</i> <i>Commutative Noetherian Rings and Modules, II</i> <i>Complex Dynamics, I</i> <i>Almost Multiplicative Maps, C* Algebras, and Deformations, I</i> <i>Model Theory, II</i> <i>Extremal Riemann Surfaces, II</i> <i>Stochastic Systems and Applications, I</i>	2:15 p.m.–4:15 p.m. MINICOURSES #5: PART B <i>An introductory mathematics course called CHANCE.</i> #9: PART A <i>Dynamic geometry via Geometer's Sketchpad.</i>	
2:15 p.m.–6:05 p.m. SESSIONS FOR CONTRIBUTED PAPERS	2:15 p.m.–6:00 p.m. CONTRIBUTED PAPER SESSIONS <i>Preparing Teachers to Implement Change, I</i> <i>Chaotic Dynamics and Fractal Geometry, I</i> <i>Innovations in Teaching Linear Algebra, I</i>	

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
WEDNESDAY (cont'd)		
<p>4:30 p.m.–5:30 p.m. COMMITTEE ON THE PROFESSION PRESENTATION <i>Math in industry.</i> Paul Davis</p>	<p>3:20 p.m.–4:10 p.m. INVITED ADDRESS <i>Teaching linear algebra with technology: Its impact</i> David R. Hill David E. Zitarelli</p> <p>3:20 p.m.–4:15 p.m. CONTRIBUTED PAPER SESSION <i>Teaching With Original Sources, II</i></p> <p>4:30 p.m.–6:30 p.m. SECTION OFFICERS MEETING</p>	<p>3:20 p.m.–4:15 p.m. AWM PANEL DISCUSSION</p> <p>4:20 p.m.–4:50 p.m. AWM BUSINESS MEETING</p> <p>5:05 p.m.–5:55 p.m. NSF INVITED ADDRESS</p>
<p>6:00 p.m.–7:00 p.m. RECEPTION FOR FIRST-TIME ATTENDEES</p>		
<p>8:30 p.m.–9:30 p.m. JOSIAH WILLARD GIBBS LECTURE <i>Turbulence, turbulent diffusion, and modern applied mathematics.</i> Andrew J. Majda</p>		<p>6:30 p.m.–8:30 p.m. MER BANQUET</p> <p>9:30 p.m.–11:00 p.m. AWM RECEPTION</p>
THURSDAY, JANUARY 5		
<p>7:00 a.m.–4:40 p.m. EMPLOYMENT REGISTER DISTRIBUTION OF SCHEDULES AND INTERVIEWS</p>		
<p>7:30 a.m.–4:00 p.m. JOINT MEETINGS REGISTRATION</p>		
<p>8:00 a.m.–10:55 a.m. AMS-MAA-MER SPECIAL SESSION <i>Mathematics and Education Reform, II</i></p>		
<p>8:00 a.m.–10:55 a.m. SPECIAL SESSIONS <i>The Simple Group Classification: Second Generation Proof and Applications, II</i></p>		

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
THURSDAY (cont'd)		
<p>8:00 a.m.–10:55 a.m. SPECIAL SESSIONS (cont'd) <i>Commutative Noetherian Rings and Modules</i>, III</p> <p><i>Complex Dynamics</i>, II</p> <p><i>Probability and Combinatorics</i>, I</p> <p><i>Almost Multiplicative Maps, C* Algebras, and Deformations</i>, II</p> <p><i>Model Theory</i>, III</p> <p><i>Extremal Riemann Surfaces</i>, III</p> <p><i>Stochastic Systems and Applications</i>, II</p>	<p>8:00 a.m.–10:00 a.m. MINICOURSES #18: PART B <i>Calculus in context.</i></p> <p>#7: PART B <i>How to use graphing calculator-based numerical and graphical methods to enhance the teaching and learning of calculus.</i></p> <p>8:00 a.m.–10:55 a.m. CONTRIBUTED PAPER SESSIONS <i>The First Two Years</i>, I</p> <p><i>Making Statistics Come Alive</i>, I</p> <p><i>Dynamic Geometry</i>, I</p> <p>8:00 a.m.–9:20 a.m. SPECIAL PRESENTATION <i>Forum on the mathematical preparation of K–6 teachers.</i></p>	<p>9:00 a.m.–9:50 a.m. AWM EMMY NOETHER LECTURE Judith D. Sally</p>
<p>9:00 a.m.–5:00 p.m. BOOK SALES AND EXHIBITS</p>		
	<p>9:30 a.m.–10:55 a.m. PANEL DISCUSSION <i>Mathematical preparation of the technical work force.</i></p> <p>9:30 a.m.–10:55 a.m. COMMITTEE ON MATHEMATICAL PREPARATION OF MINORITIES PANEL DISCUSSION <i>The emerging scholars programs: Strengthening freshman mathematics courses to achieve diversity.</i></p> <p>10:05 a.m.–10:55 a.m. INVITED ADDRESS <i>The case of J.J. Sylvester and invariant theory.</i> Karen H. Parshall</p>	<p>11:10 a.m.– Noon JPBM PUBLIC POLICY ADDRESS</p>

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
THURSDAY (cont'd)		
<p>1:00 p.m.–2:00 p.m. COLLOQUIUM LECTURE II <i>Mysteries in four dimensions.</i> Clifford Taubes</p> <p>2:15 p.m.–3:05 p.m. INVITED ADDRESS <i>Random matchings.</i> Jeff Kahn</p>	<p style="text-align: center;">2:15 p.m.–4:10 p.m. AMS-MAA-MER SPECIAL SESSION <i>Mathematics and Education Reform, III</i></p>	<p>Noon–4:15 p.m. NAM BOARD OF DIRECTORS MEETING</p>
<p>2:15 p.m.–4:10 p.m. SPECIAL SESSIONS <i>The Simple Group Classification: Second Generation Proof and Applications, III</i></p> <p><i>Complex Dynamics, III</i></p> <p><i>Almost Multiplicative Maps, C* Algebras, and Deformations, III</i></p> <p><i>Stochastic Systems and Applications, III</i></p> <p>2:15 p.m.–4:10 p.m. SESSIONS FOR CONTRIBUTED PAPERS</p> <p>3:20 p.m.–4:10 p.m. INVITED ADDRESS <i>Grothendieck-Teichmuller Theory.</i> Leila Schneps</p>	<p>2:15 p.m.–4:15 p.m. MINICOURSES #11: PART A <i>Multivariable calculus using the Harvard Calculus Consortium materials.</i></p> <p>#8: PART B <i>Learning styles approach to mathematics instruction.</i></p> <p>#9: PART B <i>Dynamic geometry via Geometer's Sketchpad.</i></p> <p>2:15 p.m.–4:10 p.m. CONTRIBUTED PAPER SESSIONS <i>Recruitment and Retention of Women Faculty, I</i></p> <p><i>Mathematical Sciences, Technology, and Economic Competitiveness, I</i></p> <p><i>Teaching With Original Sources, III</i></p> <p>2:15 p.m.–4:10 p.m. PANEL DISCUSSION <i>Advising methods that work.</i></p> <p>2:15 p.m.–4:10 p.m. PANEL DISCUSSION <i>Popularizing mathematics.</i></p> <p>2:15 p.m.–4:10 p.m. COMMITTEE ON TESTING PANEL DISCUSSION <i>Testing issues with technology.</i></p>	

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
THURSDAY (cont'd)		
4:25 p.m.–6:30 p.m. JOINT PRIZE SESSION AND RECEPTION		
<p>7:00 p.m.–10:00 p.m. SPECIAL SESSIONS <i>Cohomology and Representations of Finite Groups, I</i></p> <p><i>Nonlinear Dynamics, I</i></p> <p><i>Applied Logic, I</i></p> <p><i>Commutative Algebra: Rees Algebras and Related Topics, I</i></p> <p><i>Probability and Combinatorics, II</i></p> <p><i>Difference Equations: Theory and Applications, I</i></p> <p><i>Discrete Geometry, I</i></p> <p><i>Numerical Solution for Integro-Differential Equations, I</i></p> <p><i>Holomorphic Spaces, I</i></p> <p><i>Non Self Adjoint Operator Algebras, I</i></p> <p>7:00 p.m.–10:00 p.m. SESSIONS FOR CONTRIBUTED PAPERS</p>	<p>5:45 p.m.–7:00 p.m. TWO-YEAR COLLEGE RECEPTION</p> <p>7:00 p.m.–9:00 p.m. MINICOURSES #12: PART A <i>Linear algebra with DERIVE.</i></p> <p>#13: PART A <i>Introduction to research in the teaching and learning of undergraduate mathematics: Examples in calculus.</i></p> <p>7:00 p.m.–10:00 p.m. CONTRIBUTED PAPER SESSIONS <i>New Direction in Student Assessment, II</i></p> <p><i>Innovations in Teaching Linear Algebra, II</i></p> <p><i>Laboratory Approaches to Teaching Mathematics, II</i></p> <p>7:00 p.m.–8:20 p.m. HUMANISTIC MATHEMATICS NETWORK PRESENTATION</p> <p>7:00 p.m.–8:20 p.m. REUNION FOR CALCULUS REFORM WORKSHOP PARTICIPANTS</p> <p>8:30 p.m.–9:30 p.m. POETRY READING</p>	
FRIDAY, JANUARY 6		
	<p>7:00 a.m.–8:00 a.m. PME AND MAA STUDENT CHAPTERS ADVISORS CONTINENTAL BREAKFAST</p>	
7:30 a.m.–4:00 p.m. JOINT MEETINGS REGISTRATION		
<p>8:00 a.m.–10:55 a.m. SPECIAL SESSIONS <i>Nonlinear Dynamics, II</i></p> <p><i>Applied Logic, II</i></p>		

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
<p>FRIDAY (cont'd)</p> <p>8:00 a.m.–10:55 a.m. SPECIAL SESSIONS (cont'd) <i>Commutative Algebra: Rees Algebras and Related Topics</i>, II</p> <p><i>Probability and Combinatorics</i>, III</p> <p><i>Holomorphic Spaces</i>, II</p> <p>8:00 a.m.–10:55 a.m. SESSIONS FOR CONTRIBUTED PAPERS</p>	<p>8:00 a.m.–10:00 a.m. MINICOURSES</p> <p>#10: PART A <i>The use of symbolic computation in probability and statistics.</i></p> <p>#14: PART A <i>Recovering motivation in mathematics: Teaching with original sources.</i></p> <p>#15: PART A <i>Cooperative groups and Socratic interactions in the college mathematics classroom.</i></p> <p>#16: PART A <i>How to make fractals.</i></p> <p>8:00 a.m.–10:55 a.m. CONTRIBUTED PAPER SESSIONS <i>Recruitment and Retention of Women Faculty</i>, II</p> <p><i>Preparing Teachers to Implement Change</i>, II</p> <p>8:00 a.m.–10:55 a.m. STUDENT CHAPTERS PAPER SESSION</p> <p>8:00 a.m.–9:20 a.m. PANEL DISCUSSION <i>Preparation of beginning graduate student teaching assistants.</i></p> <p>8:00 a.m.–9:20 a.m. PANEL DISCUSSION <i>Standards for introductory college mathematics.</i></p>	
<p>8:15 a.m.–4:40 p.m. EMPLOYMENT REGISTER INTERVIEWS</p>		
<p>9:00 a.m.–9:50 a.m. INVITED ADDRESS <i>How slow can heat flow?</i> John William Lott</p> <p>9:00 a.m.–10:30 a.m. LIBRARY COMMITTEE PANEL DISCUSSION <i>Access and archiving in the electronic age.</i></p>		

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
FRIDAY (cont'd)		
9:00 a.m.–10:00 a.m. AMS SPECIAL PRESENTATION <i>e-MATH overview.</i>	<div style="border: 1px solid black; padding: 5px; text-align: center;"> 9:00 a.m.–5:00 p.m. BOOK SALES AND EXHIBITS </div>	
9:25 a.m.–10:55 a.m. SPECIAL PRESENTATION <i>Computational chemistry.</i>		
<div style="border: 1px solid black; padding: 5px; text-align: center;"> 9:30 a.m.–10:55 a.m. AMS-MAA-SIAM COMMITTEE ON PREPARATION FOR COLLEGE TEACHING PANEL DISCUSSION <i>You're the professor, what next?</i> </div>		
<div style="border: 1px solid black; padding: 5px; text-align: center;"> 9:30 a.m.–10:55 a.m. AMS COMMITTEE ON EDUCATION AND MAA EDUCATION COUNCIL PANEL DISCUSSION <i>GRE mathematics reasoning examination.</i> </div>		
10:05 a.m.–10:55 a.m. INVITED ADDRESS <i>Mirror symmetry: A bridge between singularity theory and symplectic topology.</i> Alexander B. Givental	9:45 a.m.–10:45 a.m. JPBM FORUM ON MATHEMATICS AWARENESS WEEK	
<div style="border: 1px solid black; padding: 5px; text-align: center;"> 11:10 a.m.–Noon INVITED ADDRESS <i>Ingenious mathematical amateurs: M.C. Escher (artist) and Marjorie Rice (homemaker).</i> Doris J. Schattschneider </div>		
1:00 p.m.–2:00 p.m. COLLOQUIUM LECTURE III <i>Mysteries in three dimensions.</i> Clifford Taubes		
1:00 p.m.–3:20 p.m. SPECIAL SESSIONS <i>Nonlinear Dynamics, III</i>		

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
<p>FRIDAY (cont'd)</p> <p>1:00 p.m.–3:20 p.m. SPECIAL SESSIONS (cont'd) <i>Applied Logic</i>, III</p> <p><i>Commutative Algebra: Rees Algebras and Related Topics</i>, III</p> <p><i>Holomorphic spaces</i>, III</p> <p>1:00 p.m.–4:00 p.m. SPECIAL SESSION <i>Probability and Combinatorics</i>, IV</p> <p>1:00 p.m.–6:20 p.m. SPECIAL SESSIONS <i>Cohomology and representations of Finite Groups</i>, II</p> <p><i>Difference Equations: Theory and Applications</i>, II</p> <p><i>Discrete Geometry</i>, II</p> <p><i>Numerical Solution for Integro-Differential Equations</i>, II</p> <p><i>Non Self Adjoint Operator Algebras</i>, II</p> <p>1:00 p.m.–6:20 p.m. SESSIONS FOR CONTRIBUTED PAPERS</p> <p>3:15 p.m.–4:45 p.m. COMMITTEE ON SCIENCE POLICY PANEL DISCUSSION</p> <p>3:30 p.m.–6:00 p.m. SPECIAL SESSIONS <i>Geometric Function Theory in One and Several Complex Variables</i>, I</p> <p><i>Multivalued Dynamical Systems and Applications</i>, I</p> <p><i>Noncommutative Algebra</i>, I</p> <p><i>Effective Approaches to the Training of Teaching Assistants</i>, I</p>	<p>1:00 p.m.–3:00 p.m. MINICOURSES #10: PART B <i>The use of symbolic computation in probability and statistics.</i></p> <p>#14: PART B <i>Recovering motivation in mathematics: Teaching with original sources.</i></p> <p>#17: PART A <i>An introduction to numerical modeling.</i></p> <p>1:00 p.m.–3:30 p.m. COMMITTEE ON COMPUTERS IN MATHEMATICS EDUCATION AND THE COMMITTEE ON ELECTRONIC SERVICES PANEL DISCUSSION <i>The information superhighway and you.</i></p> <p>1:00 p.m.–6:00 p.m. CONTRIBUTED PAPER SESSIONS <i>Chaotic Dynamics and Fractal Geometry</i>, II</p> <p><i>Innovations in Teaching Linear Algebra</i>, III</p> <p>1:00 p.m.–3:30 p.m. OPEN FORUM Discussion of the CTUM/CUPM Agenda.</p> <p>2:15 p.m.–3:05 p.m. INVITED ADDRESS <i>Research in the teaching and learning of calculus: Progress and potential.</i> Joan Ferrini Mundy</p> <p>3:20 p.m.–5:00 p.m. TEACHING AWARDS PRESENTATIONS</p>	<p>2:15 p.m.–4:10 p.m. RMMC BOARD OF DIRECTORS MEETING</p> <p>2:15 p.m.–4:00 p.m. NAM SESSION <i>Presentations by recent doctoral recipients.</i></p>

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
FRIDAY (cont'd)		
<p>5:00 p.m.–5:50 p.m. COMMITTEE ON SCIENCE POLICY GOVERNMENT SPEAKER</p> <p>5:15 p.m.–6:15 p.m. MATHEMATICAL REVIEWS RECEPTION</p>	<p>5:05 p.m.–6:20 p.m. INFORMAL SESSION <i>Actuarial education.</i></p>	<p>5:30 p.m.–9:00 p.m. NAM BANQUET AND COX TALBOT ADDRESS</p>
<p>7:00 p.m.–10:00 p.m. SPECIAL SESSION <i>Research In Undergraduate Mathematics Education, I</i></p>		
<p>7:00 p.m.–10:00 p.m. SPECIAL SESSION <i>Nonlinear Elliptic Boundary Value Problems and Applications, I</i></p> <p><i>Undergraduate Research, I</i></p> <p><i>Graph Theory, I</i></p> <p><i>Geometric Function Theory in Several Complex Variables, II</i></p> <p><i>Multivalued Dynamical Systems and Applications, II</i></p> <p><i>Noncommutative Algebra, II</i></p> <p><i>Index Theory and Elliptic Operators on Manifolds, I</i></p> <p><i>Effective Approaches to the Training of Teaching Assistants, II</i></p>	<p>7:00 p.m.–9:00 p.m. MINICOURSES #12: PART B <i>Linear algebra with DERIVE.</i></p> <p>#19: PART A <i>An introduction to fractal functions and fractal surfaces and their connection to wavelet theory.</i></p> <p>#21: PART A <i>Mathematical modeling.</i></p> <p>7:00 p.m.–10:00 p.m. CONTRIBUTED PAPER SESSIONS <i>Making Statistics Come Alive, II</i></p> <p><i>Mathematical Sciences, Technology, and Economic Competitiveness, II</i></p>	
<p>7:00 p.m.–10:00 p.m. SESSIONS FOR CONTRIBUTED PAPERS</p> <p>7:00 p.m.–8:20 p.m. COMMITTEE ON THE PROFESSION PRESENTATION <i>Looking for a job in industry.</i> Stanley J. Benkoski</p>		
	<p>7:30 p.m.–8:20 p.m. COMMITTEE ON STUDENT CHAPTERS LECTURE <i>Newton's (Original) Method—or— Though this be method, yet there is madness in't.</i> William Dunham</p>	

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
SATURDAY, JANUARY 7		
7:30 a.m.–2:00 p.m. JOINT MEETINGS REGISTRATION		
<p>8:00 a.m.–10:55 a.m. SPECIAL SESSIONS <i>Nonlinear Elliptic Boundary Value Problems and Applications</i>, II <i>History of Mathematics</i>, I <i>Undergraduate Research</i>, II <i>Graph Theory</i>, II <i>Environmental Modeling</i>, I <i>Geometric Function Theory in One and Several Complex Variables</i>, III <i>Multivalued Dynamical Systems and Applications</i>, III <i>Theory and Applications of Nonlinear Operators of Accretive and Monotone Type</i>, I <i>Noncommutative Algebra</i>, III <i>Index Theory and Elliptic Operators on Manifolds</i>, II <i>Effective Approaches to the Training of Teaching Assistants</i>, III <i>Homotopy Theory</i>, I</p> <p>8:00 a.m.–10:55 a.m. SESSIONS FOR CONTRIBUTED PAPERS</p> <p>8:30 a.m.–10:00 a.m. COMMITTEE ON EDUCATION PANEL DISCUSSION <i>Can we evaluate teaching or research in the mathematical sciences?</i></p> <p>9:00 a.m.–6:00 p.m. COUNCIL MEETING</p>	<p>8:00 a.m.–10:00 a.m. MINICOURSES #13: PART B <i>Introduction to research in the teaching and learning of undergraduate mathematics: Examples in calculus.</i> #20: PART A <i>Doing discrete mathematics with undergraduates.</i> #6: PART A <i>Exploring MathKit microworlds.</i></p> <p>8:00 a.m.–10:55 a.m. CONTRIBUTED PAPER SESSIONS <i>Experiences With Modeling in Elementary Differential Equations</i>, I <i>The First Two Years</i>, II <i>Dynamic Geometry</i>, II</p> <p>8:00 a.m.–9:00 a.m. SPECIAL PRESENTATION <i>Assessing calculus reform efforts—A report to the community.</i></p> <p>9:00 a.m.–9:50 a.m. INVITED ADDRESS <i>Computing over the reals.</i> Lenore Blum</p>	<p>9:00 a.m.–5:00 p.m. AWM WORKSHOP</p> <p>9:00 a.m.–10:00 a.m. NAM PANEL DISCUSSION <i>NAM's first quarter of a century: The past, the present, and the future.</i></p>

Timetable

American Mathematical Society	Mathematical Association of America	Other Organizations
SATURDAY (cont'd)		
9:00 a.m.– Noon BOOK SALES AND EXHIBITS		
<p>11:45 a.m.–12:15 p.m. BUSINESS MEETING</p>	<p>9:30 a.m.–10:55 a.m. PANEL DISCUSSION <i>Classroom climate scenarios: What would you do if...?</i></p> <p>10:05 a.m.–10:55 a.m. INVITED ADDRESS <i>Rolle's Theorem: Historical remarks, recent developments, a multi-dimensional version, and a conjecture.</i> Mario U. Martelli</p> <p>11:10 a.m.–11:40 a.m. BUSINESS MEETING</p>	<p>10:00 a.m.–10:50 a.m. NAM BUSINESS MEETING</p> <p>1:00 p.m.–2:00 p.m. NAM WILLIAM W.S. CLAYTOR LECTURE</p>
1:00 p.m.–5:30 p.m. SPECIAL SESSION <i>Research In Undergraduate Mathematics Education, II</i>		
<p>1:00 p.m.–6:30 p.m. SPECIAL SESSIONS <i>Nonlinear Elliptic Boundary Value Problems and Applications, III</i></p> <p><i>History of Mathematics, II</i></p> <p><i>Undergraduate Research, III</i></p> <p><i>Graph Theory, III</i></p> <p><i>Environmental Modeling, II</i></p> <p><i>Theory and Applications of Nonlinear Operators of Accretive and Monotone Type, II</i></p> <p><i>Index Theory and Elliptic Operators on Manifolds, III</i></p> <p><i>Homotopy Theory, II</i></p>	<p>1:00 p.m.–3:00 p.m. MINICOURSES</p> <p>#11: PART B <i>Multivariable calculus using the Harvard Calculus Consortium materials.</i></p> <p>#15: PART B <i>Cooperative groups and Socratic interactions in the college mathematics classroom.</i></p> <p>#16: PART B <i>How to make fractals.</i></p> <p>#6: PART B <i>Exploring MathKit microworlds.</i></p>	

Mathematical Sciences Employment Register

San Francisco Hilton

January 4, 5, & 6, 1995

Overview of the Employment Register

The Mathematical Sciences Employment Register, held annually at the Joint Mathematics Meetings in January, provides opportunities for mathematical scientists seeking professional employment to meet employers who have positions to be filled. Job announcements and brief résumés, prepared by employers and applicants respectively, are assigned code numbers and circulated to participants in advance and at the meetings so that members of each group may determine which members of the other group they would like to have an opportunity to interview. Requests for interviews are submitted on forms that are turned in at the Employment Register Desk by all participants the day before interviewing begins. **The algorithm used in the interview scheduling program selects interviews solely from among the requests submitted by employers and applicants. Since it does NOT compare an applicant's brief résumé with an employer's job announcement, participants should be aware that interviews between poorly matched participants may occur, if requested.** All participants are strongly advised to choose interview requests carefully to maximize the effectiveness of the Employment Register system.

Priority is given to certain classes of employer and applicant requests. Specifically, mutual requests (requests where an applicant and employer have each asked to interview the other) are virtually assured of being scheduled utilizing a new scheduling algorithm introduced in 1993. Employer requests are also given priority, as are the requests by applicants that applicants designate "high priority". Under this scheduling system, employers in 1993 and 1994 interviewed 100 percent of the applicants they requested (who were actually present at the Employment Register). The new system is based on computer code developed by J.P. Jarvis, M. Myers, and D.R. Shier of the Department of Mathematical Sciences, Clemson University, under a contract with the AMS sponsored jointly by the AMS and the Mathematical Association of America.

The Mathematical Sciences Employment Register is sponsored by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics; it is operated by members of the AMS staff under the general supervision of the AMS-MAA-SIAM Committee on Employment Opportunities.

All interviewing employers and applicants **MUST** appear at the Employment Register Desk to submit their request/availability sheets by 4:00 p.m. Wednesday, January 4, 1995, regardless of whether they have registered in advance. Those who will not be able to appear on Wednesday should not plan to participate. Should unexpected delays occur while travelling, contact the Employment Register Desk by telephone at 401-455-4140 before 4:00 p.m. EST on Wednesday, January 4.

Advance Registration Procedures for Applicants

Advance registration is an important step in Employment Register participation that offers several advantages:

- Advance registration fees for applicants are \$35, plus Joint Meetings registration fee, vs. \$70 on-site registration fee, plus Joint Meetings registration fee. **N.B. There is a new temporarily employed Joint Meetings registration category. Please refer to page 981 for further information.**
- Each typed Applicant's Résumé Form will be reproduced in a booklet, the *Winter List of Applicants*, and distributed to all registered employers. Applicant Résumé Forms received after November 16, 1994, cannot be included in the booklet. The booklet allows employers more time to examine each candidate's qualifications in advance.
- Applicants registered in advance will receive their badges, programs, and Employment Register materials two to three weeks in advance of the meeting, unless they request otherwise. The package will include the complete job announcements received from employers registered by November 16.

Applicants may register in advance by submitting the Joint Meetings Advance Registration/Housing Form and Applicant Résumé Form (all found in the back of this issue) to the Mathematics Meetings Service Bureau **by November 16**. These forms must be accompanied by payment of the appropriate fees. Applicant Résumé Forms received by the November 16 deadline will be included in the *Winter List*. Advance registration for the Employment Register will continue until the Final Registration deadline of **December 7, 1994**; however, the Résumé Form will NOT be included in the *Winter List* but will be posted on site at the Employment Register. Those who do not register by December 7 must register on site at the Joint Meetings Registration Desk and pay the higher fees.

Advice to Applicants

Applicants should be aware of some objective information concerning recent Employment Registers:

- At the 1994 Employment Register in Cincinnati, the ratio of applicants to interviewers was more than six applicants to one interviewer.
- The employers who responded to the 1994 follow-up survey (76%) reported giving 134 invitations for on-campus interviews to Employment Register applicants, and they reported making 88 job offers to applicants.
- In Cincinnati the average total number of interviews for each applicant was just over five.
- Most jobs listed required a doctorate.
- Most jobs listed have been academic positions at bachelor's-granting institutions.
- Over 60% of the employers interviewing at the Employment Register in Cincinnati indicated that they were restricted by their institution or company to hiring only U.S. citizens or permanent residents.

Applicants should obtain their materials in time to examine all job listings carefully and make interview requests appropriately. They are likewise encouraged to complete the Applicant Résumé Form carefully to ensure that employers are aware of any geographical or other restrictions they may have, along with any special experience or qualifications they want prospective employers to know about. Those with schedule conflicts during the Joint Meetings should indicate that they are unavailable for one or more half-day sessions.

Applicants should keep in mind that interviews arranged by the Employment Register represent only an initial contact with the employers and that hiring decisions are not ordinarily made during or immediately following such interviews. Applicants are advised to bring a number of copies of their vita or résumé so that they may leave them with prospective employers; or applicants may wish to mail materials several weeks in advance directly to participating employers in which they are particularly interested.

Advance Registration Procedures for Employers

Representatives of mathematical sciences departments and private or governmental organizations who plan to contact job seekers at the Joint Mathematics Meetings in San Francisco are encouraged to register one or more interviewers in advance for the Employment Register.

- The fee for employers to register in advance is \$150 for the first interviewer and \$75 for each additional interviewer. On-site registration fees are \$200 for the first interviewer and \$100 for each additional interviewer. Employers must also register for the Joint Meetings and pay the appropriate Joint Meetings fee.
- Employer Forms submitted by November 16 will be photographically reproduced in a booklet which will be distributed to all applicants. Employers may elect to receive their badges, programs, and Employment Register material in advance, including the *Winter List of Applicants* containing all the Résumé Forms of applicants registered

by November 16. Employers should be aware that there will be hundreds of brief résumés to look through and should be sure to obtain the *Winter List of Applicants* as early as possible.

To register in advance employers should submit the Employer Form and the Joint Meetings Advance Registration/Housing Form (both found in the back of this issue), along with payment of the appropriate fees, to the Mathematics Meetings Service Bureau by **November 16**.

One Employer Form should be submitted for each position or set of positions for which interviews will be conducted. All co-interviewers should register at the same time. Each interviewer listed on an Employer Form will be charged separate Joint Meetings and Employment Register fees; however, the "additional interviewers" listed on the form will be charged a lower Employment Register fee. Co-interviewers may share one or more tables by working together or in shifts. If individuals from an institution want to interview separately for different positions, they will be assigned a separate code number and table and will each pay "first interviewer" fees.

It is the policy of some institutions to pay directly for employer fees. If a payment of this type is made separately from the submission of the advance registration materials, it is important that the institution's fiscal department include the name of the department and interviewer with their payment so that proper credit can be made in the Providence office.

Advice to Employers

Employers should know about several flexible options for participation in the Employment Register:

- Participants may register for any subset of the four half-day sessions.
- The schedule allows fifteen-minute interviews, with five minutes between for note taking.
- One or more interviewers for the same position(s) may interview separately, together, or in shifts.
- Employers may elect to receive a booklet containing hundreds of Applicant Résumés Forms two to three weeks in advance.
- ALL interview request forms must be submitted on Wednesday; then on Thursday and Friday employers will interview almost all of the applicants they requested. Most employers at the Cincinnati meeting report that they met with excellent candidates among the group of applicants who had requested interviews with them.

Employers should bring school catalogs, corporate reports, or more lengthy job descriptions to the Employment Register Desk early on Wednesday for perusal by applicants prior to interviews.

Registration on Site

Applicants and employers who do not register for the Joint Mathematics Meetings and the Employment Register by **December 7** may register on site in San Francisco at the Joint Meetings Registration Desk. They must bring their receipt to the Employment Register Desk between 7:30 a.m. and 4:00

p.m. on **Wednesday, January 4**, to receive their materials. Every effort should be made to type the Applicant Résumé or Employer Form (found in the back of this issue) and bring it to the Register. Participants should keep in mind that on-site registration should be done as early on Wednesday as possible to allow a longer time for their Résumé Form or job listing to be viewed by other participants and also to allow time to examine materials before making their own interview requests. **There will be no on-site registration for the Employment Register after 4:00 p.m. Wednesday, January 4.**

1995 Employment Register Schedule

Wednesday, January 4

- 7:30 a.m. Distribution of Employment Register material for on-site registrants and participants registered in advance who did not receive materials by mail.
- 9:00 a.m. Short (optional) orientation session.
- 9:30 a.m.–4:00 p.m. Submission of all interview request forms for both Thursday and Friday interviews. This applies to both advance and on-site registrants. Those who do not submit interview request sheets by 4:00 p.m. will be unable to participate in the Employment Register on Thursday and Friday.
- 1:00 p.m.–4:00 p.m. Help Room open for résumé and job hunting advice.
- *N.B. No interviews are held on Wednesday.*

Thursday, January 5

- 7:00 a.m.–8:15 a.m. Distribution of interview schedules for both Thursday and Friday.
- 8:15 a.m.–4:40 p.m. Interviews.

Friday, January 6

- 8:15 a.m.–4:40 p.m. Interviews.

All participants in the 1995 Employment Register must submit their Interview Request/Availability Forms between 9:30 a.m. and 4:00 p.m. on Wednesday, or they will not be included when the interview scheduling program runs Wednesday night. This applies to all employers and applicants, whether advance or on-site registrants. Forms submitted with advance registration do not automatically include the participants in the interviewing process.

Interviews now occur at twenty-minute intervals with five minutes between successive interviews. The interviews are scheduled in half-day sessions: Thursday morning and afternoon, and Friday morning and afternoon, amounting to four half-day sessions for interviews. The allowed number of interview requests will be determined based on half-day sessions to be attended. Participants may choose to indicate unavailability for one or more sessions when they submit interview request forms. However, once scheduled, participants need to make a good faith effort to meet each appointment. Employers or applicants who must cancel an interview should fill out a cancellation form at the Employment Register Desk well in advance.

Winter List of Applicants

The *Winter List of Applicants* contains résumés of persons seeking professional positions in the mathematical sciences and is distributed to all employers interviewing at the Employment Register. Résumé Forms of applicants taking part in the Employment Register and those not attending will be included provided they are received before the November 16 deadline. No changes may be made after the form is submitted.

Copies of the booklet will be available for sale at the AMS Exhibit and Book Sale at the meeting for \$10. Any copies remaining after the meeting will be available from the Providence office of the Society for \$17 each. Please note that the booklet will no longer be distributed as part of the *EIMS* subscription.

Applicants Not Planning to Attend

Applicants seeking professional positions in the mathematical sciences who do not plan to attend the Employment Register in San Francisco also may submit the Applicant Résumé Form at the back of this issue for publication in the *Winter List of Applicants*. Please indicate that you are not attending the meeting and observe the deadline of November 16. There is no charge for this service.

Winter List of Employers

The *Winter List of Employers* consists of the position listings submitted by employers who submitted job descriptions by November 16. It will be distributed to the applicants participating in the Register. Others may purchase the *Winter List of Employers* at the AMS Exhibit and Book Sale at the meeting for \$10 each. Any copies remaining after the meeting will be available from the Providence office of the Society for \$17 each.

Employers Not Planning to Interview

Employers who do not plan to participate in the Employment Register may display a job description. This description must be submitted on the Employer Form which appears in the back of this issue, with the appropriate box checked indicating that no interviews will take place. A fee of \$50 is charged for this service. If the form is received in the Providence office (with payment) **by the November 16 deadline**, it will appear in the *Winter List of Employers*. Forms received with payment in the Providence office after that deadline will be displayed at the meeting. For on-site postings the fee of \$50 must first be paid at the Joint Mathematics Meetings Registration Desk. Participants should inform the cashier that they would like to post a job description but are not planning to interview and should obtain the proper receipt. Additional forms are available at the Employment Register Desk.

For Further Information

Questions about the Employment Register should be addressed to the Employment Register Coordinator at the AMS, 401-455-4140, or by e-mail: wsd@math.ams.org.

Short Courses, San Francisco, California

January 2–3, 1995

The American Mathematical Society, in conjunction with its one hundred-and-first Annual Meeting, will present two 2-day Short Courses on Monday and Tuesday, January 2 and 3, 1995, at the Hilton Hotel. The titles of the Short Courses and the names and affiliations of the organizers are *Coding theory*, **A. Robert Calderbank**, AT&T Bell Labs, and *Knots and physics*, **Louis H. Kauffman**, University of Illinois at Chicago.

Lecture notes will be mailed to those who register in advance and will be available at the Short Course registration desk for those registering on site.

Advance registration fee: \$75 (\$35 student/unemployed/emeritus). On-site registration fee: \$90 (\$45 student/unemployed/emeritus). Registration and housing information can be found in this issue of *Notices*; see the section *Registering in Advance and Hotel Accommodations* in the Meetings section.

Tentative Schedule for *Coding theory*

Monday, January 2, 1995

A. Robert Calderbank, *Introduction to coding theory*.

Paul H. Siegel, IBM Almaden Research Center, *Modulation codes for digital data storage*.

Brian Marcus, IBM Almaden Research Center, *Dynamics and connections to coding theory, automata theory, and system theory*.

Tuesday, January 3, 1995

Joan Feigenbaum, AT&T Bell Laboratories, *The use of codes in complexity theory*.

William M. Kantor, University of Oregon, *Quadratic forms and finite geometries*.

Henning Stichtenoth, University of Essen, *Algebraic geometric codes*.

N. J. A. Sloane, AT&T Bell Laboratories, *Codes (spherical) and designs (experimental)*.

Synopses and Reading Lists

• *Introduction to coding theory* (A. Robert Calderbank)

This lecture will give basic definitions and will set the stage for the featured presentations. Developments in coding theory have always been stimulated by three types of problems: those arising in number theory, in geometry, and in the physical world. The lectures will illustrate these three forces at work.

• *Modulation codes for digital data storage* (Paul Siegel)

Strings of binary information to be stored on a digital recording device, such as a magnetic disk or tape drive,

undergo a transformation before the actual recording process. The transformation, effected by a synchronous finite-state-machine, generates binary code sequences that comprise what is called a modulation code. The code sequences belong to a constrained system of strings generated by walks on a labeled, directed graph. The particular choice of constraint graph for a given recording device depends upon several features of the device: characteristics of the electronic readback signal, sources of noise and other signal distortions, the detection method used to reconstruct the recorded sequences from the noisy readback signal, and properties of the electronic circuits themselves. Most modulation codes used in digital recording are based upon systems that can be classified as runlength-limited constraints or spectral-null constraints or both.

The mathematical study of such constrained systems was initiated by Shannon—who called them discrete noiseless channels—in 1948. Many fundamental questions were raised and some answered, at least in part, in that seminal work: What is the upper bound on the efficiency of an invertible code transformation? What limitations are there on the finite-state-machine complexity? In the past decade, definitive solutions to these and related questions, refinements, and generalizations have arisen from the interplay between coding theory and symbolic dynamics, a connection first discovered in the context of modulation codes for digital recording.

We will describe key concepts and results in the mathematical theory of modulation codes and practical code design. These will be illustrated with examples of runlength-limited codes and spectral-null codes as applied in conventional storage devices using analog signal processing, as well as the coming generation of devices that exploit digital signal-processing techniques.

No prior knowledge of magnetic recording, signal processing, or symbolic dynamics will be assumed.

References

[1] Schouhamer Immink, K. A., *Coding techniques for digital recorders*, Prentice-Hall, 1991.

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[3] Marcus, B., Siegel, P., Wolf, J., *Finite-state modulation codes for data storage*, IEEE J. Selec. Areas Commun., Special Issue on Signal Processing and Coding for Recording Channels, **10**, no. 1 January (1992), 5–37.

[4] Karabed, R. and Siegel, P., *Matched spectral null codes for partial response channels*, IEEE Trans. Info. Th., Special Issue on Coding for Storage Devices, **37**, no. 3, pt. II (1991), 818–855.

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• **Symbolic dynamics and connections to coding theory, automata theory, and system theory** (Brian Marcus).

This talk will survey symbolic dynamics and explore common themes as well as different points of view with respect to branches of coding theory, automata theory, and system theory. The connections among these subjects will be illustrated by a multilingual dictionary, which will be included in the lecture notes.

We will begin by tracing the origins of symbolic dynamics as models of smooth dynamical systems. The models are spaces of sequences. Then we will review some of the fundamental equivalence problems of symbolic dynamics and see how they can be formulated concretely as coding problems. Notions from automata theory fit naturally here as descriptions of the spaces of sequences as well as the encoders and decoders. Then we will see how results in symbolic dynamics give rise to encoder/decoder constructions—in particular, for spaces that arise in magnetic recording and for spaces with group structure. Finally, we will make some connections between symbolic dynamics and a branch of system theory.

The following reading list is suggested: M. P. Beal, *Codage Symbolique*; Forney (survey paper on *Convolutional coding*); Forney and Trott (*Group codes* paper); Kitchens (*Expansive dynamics* paper); Lin and Costello (textbook); Lind and Marcus (*Intro to symbolic dynamics*); Marcus, Siegel and Wolf (survey article); Willems (survey article).

• **The use of codes in complexity theory** (Joan Feigenbaum)

Complexity theory is the study of efficient computation. Faced with a computational problem that can be modelled formally, a complexity theorist seeks first to find a solution that is provably efficient and, if such a solution is not found, to prove that such a solution does not exist. Coding theory, which provides techniques for “robust representation” of information, is valuable both in designing efficient solutions and in proving that efficient solutions do not exist.

This article surveys the use of codes in complexity theory. Examples of the topics surveyed include:

Small-bias probability spaces (e.g., [6]):

In this example the relevant measure of “efficiency” is the number of random bits used by a probabilistic algorithm. Many natural problems have straightforward probabilistic algorithms that use n random bits on instances of size n in order to achieve error probability at most e . Coding theory can be used to devise algorithms that require only $O(\log n + \log 1/e)$ random bits and have the same error probability.

Crypto-complexity (e.g., [5]):

Here the relevant measure of “efficiency” is the strength of an unproven hypothesis that must be granted in order to guarantee the desired outcome. (Perhaps “credibility” is a better term than “efficiency” here.) For example, the correctness of certain cryptographic protocols can only be

proven under the assumption that factoring large integers is infeasible. An important goal in crypto-complexity is to find protocols that can be proven correct under weaker assumptions. The best one can hope for is a proof that one’s protocol is correct if any “one-way function” exists. Intuitively a function is one-way if it is easy to compute but hard to invert. Thus, integer multiplication is conjectured to be one-way, but it is certainly conceivable that an efficient factoring algorithm will be found and, if it is, that one would like to use another purported one-way function in a protocol. Coding theory is crucial to the proof that “bit commitment”, an essential building block of cryptographic protocols, can be based on any one-way function.

Nonapproximability of NP-Hard and PSPACE-Hard functions (e.g., [1, 2, 3, 4]):

In this family of examples, coding theory is used to prove lower bounds rather than to devise efficient solutions. Natural optimization problems that are complete for the complexity classes NP and PSPACE abound in many application areas. These completeness results are interpreted as evidence that algorithms that solve these problems exactly will have high time or space complexity. An obvious question is whether more time-efficient or space-efficient algorithms can be found if one is willing to settle for approximate rather than exact solutions. Coding theory plays a central role in the proof that, for many important optimization problems, the answer to this question is no: approximating the optimum value closely is provably as hard as finding it exactly.

References

[1] Arora S. and Safra, M., *Probabilistic checking of proofs*, Proc. of 33rd Symposium on Foundations of Computer Science, IEEE Computer Society Press, Los Alamitos, 1992, 2–13.

[2] Arora, S., Lund, C., Motwani, R., Sudan, M., and Szegedy, M., *Proof verification and hardness of approximation problems*, Proc. of 33rd Symposium on Foundations of Computer Science, IEEE Computer Society Press, Los Alamitos, 1992, 14–23.

[3] Condon, A., Feigenbaum, J., Lund, C., and Shor, P., *Probabilistically checkable debate systems*, Proc. of 25th Symposium on Theory of Computing, ACM, New York, 1993, 305–314.

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[5] Naor, M., *Bit commitment using pseudorandomness*, J. Cryptology, **4** (1991), 151–158.

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• **Codes, quadratic forms, and finite geometry** (William M. Kantor)

This talk will connect binary error-correcting codes, orthogonal and symplectic geometry, and systems of Euclidean lines with few angles. Some of these connections involve the recent discovery that certain extremal nonlinear binary codes defined using quadratic forms can be viewed as linear codes over the integers modulo 4. Our emphasis will be geometric and combinatorial properties of highly structured families of codes.

References

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- **Algebraic geometric codes** (Henning Stichtenoth)

In 1975 Valeri Goppa discovered a very general method of constructing codes from algebraic curves. These codes are called algebraic geometry codes or geometric Goppa codes. They are interesting to mathematicians because the dimension and minimum distance of an algebraic geometry code is intimately related to the Riemann-Roch theorem which is central to the theory of algebraic curves. This surprising link between coding theory and algebraic geometry has turned out to be fruitful for both subjects, generating new results and many questions.

The goal of the lecture is to give an introduction to Goppa's approach and to present some of the main results:

- 1) families of codes which are better than the Gilbert-Varshamov bound (the theorem of Tsfasman, Vladut, and Zink),
- 2) decoding geometric Goppa codes,
- 3) curves over finite fields with many rational points.

We do not assume familiarity with algebraic geometry, and we shall instead use the more elementary language of algebraic function fields.

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[2] van Lint, J. H., van der Geer, G., *Introduction to coding theory and algebraic geometry*, Birkhauser, 1988.

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- **Codes (spherical) and designs (experimental)** (N. J. A. Sloane)

This talk will discuss the optimal placement of N points in the sphere, ball or cube. One of the main areas of application is in the design of experiments, and examples will be presented from integrated circuit manufacture, consumer product testing, food preparation, drug testing, genetic engineering, etc. Other applications include the optimal placement of laser beams for treating tumors, the construction of signals for digital communication, the construction of spherical t -designs, and the discovery of algebraic identities connected with Waring's problem. For example, $(w^2 + x^2 + y^2 + z^2)^3$ can be written as a sum of 23 sixth powers of linear forms. This is based on joint work with R. H. Hardin and other collaborators. Handouts

will be mailed separately and will include *Groping in the dark* and *Spherical 4-designs*.

Tentative schedule for *Knots and physics*

Monday, January 2, 1995

Louis H. Kauffman, University of Illinois at Chicago, *Knots and statistical mechanics*.

Ruth J. Lawrence, University of Michigan, *Topological quantum field theories*.

Dror Bar-Natan, Harvard University, *Vassiliev and quantum invariants of braids*.

Tuesday, January 3, 1995

Nicolai Reshetikhin, University of California, Berkeley, *Quantization and invariants of links and 3-manifolds*.

Lee Smolin, Pennsylvania State University, *Spin networks in nonperturbative quantum gravity*.

Sam Lomonaco, University of Maryland, Baltimore, *The modern legacies of Thomson's atomic vortex theory in classical electrodynamics*.

Synopsis and Reading Lists

- ***Knots and statistical mechanics*** (Louis H. Kaufmann)

A knot is an embedding of a circle into Euclidean three-dimensional space. The theory of knots studies the problem of classification of such embeddings up to the equivalence relation of ambient isotopy. Two knots are ambient isotopic if there is a one-parameter continuous family of embeddings starting at the first knot and ending at the second knot. Since this classification problem can be modelled by the macroscopic properties of rope in ordinary space (or by molecules in micro-space), there is a direct connection between knots and physics. Moreover, since the advent of the Jones polynomial and its generalizations, it has become apparent that the theory of knots is deeply connected with the techniques and ideas in modern statistical mechanics.

In this lecture we shall begin by recalling the history of knot theory. Knot theory had its start with the construction of the first tables of knots. These tables were constructed at the behest of Lord Kelvin, who theorized that atoms were knotted vortices in the ether. We then review the history of the Alexander polynomial by a remarkable variation of parameters.

We then discuss the Jones polynomial, its direct modelling via discrete statistical mechanics, and the generalizations of these ideas via the Yang-Baxter equation and Hopf algebras. The lecture concludes with a brief introduction to Witten's approach to invariants of knots and three-manifolds via functional integrals.

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[2] Atiyah, M., *The geometry and physics of knots*, Cambridge Univ. Press, 1990.

[3] Baxter, R., *Exactly solved models in statistical mechanics*, Academic Press, 1982.

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- **Topological quantum field theories** (Ruth J. Lawrence)

A topological quantum field theory (TQFT) is a metric independent quantum field theory that gives rise to topological invariants of the background manifold. The most well-known example of a 3-dimensional TQFT is Chern-Simons-Witten theory, on which the expectation value of an observable, obtained as the product of the Wilson loops associated with a link, is the generalized Jones invariant of the link.

Unfortunately the form for the invariants obtained by this procedure is as an integral over an infinite-dimensional space on which a measure is not mathematically rigorously defined. Various ways of avoiding this difficulty have been developed. These fall into two main categories, namely, formal manipulations of Witten's path integral into a form which can be rigorously defined and axiomatic encapsulations of the properties of TQFTs. In this lecture we will mainly be concerned with the second path, showing how the categorical and algebraic structures which appear are related to the quantum group structures which arise in other approaches.

Reading List: M.F. Atiyah, *The geometry and physics of knots*, Lezione Lincee CMP. 1990.

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E. Witten, *Quantum field theory and the Jones polynomial*, Commun. Math. Phys. **121** (1989), 351-389.

- **Vassiliev and quantum invariants of braids** (Dror Bar-Natan)

There is a reasonably natural way to extend any knot (or link, or braid, or tangle, etc.) invariant V to be an invariant of 'singular knots' (links, braids, ...) in which a single transversal self-intersection is allowed. Indeed, the self-intersection can be 'resolved' by separating the strands passing through the intersection point in two ways, either to become an 'overcrossing' or an 'undercrossing'. The difference between the values of V on these two possible resolutions then becomes the *definition* of V evaluated on the original, singular, knot:

$$(1) \quad V(\text{sing}) = V(\text{over}) - V(\text{under}).$$

This definition can then be iterated, and V can be extended to be an invariant of singular knots (links, braids, ...) in which any number of transversal self-intersections is allowed. Such an invariant V is called a *Vassiliev invariant of type m* if its extension to knots having more than m self-intersections vanishes:

$$V \left(\underbrace{\text{sing} \cdots \text{sing}}_{> m} \right) = 0.$$

Differences are cousins of derivatives, and hence (1) can be viewed as defining 'differentiation' of knot invariants. From this perspective, V extended to knots with exactly m self-intersections is like the m th derivative of the original V , and Vassiliev invariants, all of whose high 'derivatives' vanish, are the analogs of polynomials on \mathbf{R}^n . Thus in some sense, Vassiliev invariants more deserve to be called "knot polynomials" than the famous knot polynomials of Alexander-Conway, Jones, HOMFLY, etc. Fortunately, properly reinterpreted, all of those (and some other) knot polynomials turn out to actually be Vassiliev invariants. In fact, it is conjectured that (in the appropriate sense) all Vassiliev invariants come from the Jones polynomial and its various 'quantum group' generalizations.

If this conjecture is indeed true, studying Vassiliev invariants is similar to studying the invariants coming from quantum groups. But as the definition of Vassiliev invariants is so much simpler than that of quantum groups, one may hope that studying them would be much easier and would lead to results that within the context of quantum groups seem inaccessible. Several such results have been obtained already, and the purpose of our lecture is to describe another — we prove that quantum group invariants associated with the group $GL(N)$ (that is, various 'cablings' of the HOMFLY polynomial) separate braids by first recalling that Vassiliev invariants separate braids, and then showing that all Vassiliev invariants of braids come (in the appropriate sense) from the algebra $gl(N)$.

Recommended reading:

D. Bar-Natan, *On the Vassiliev knot invariants*, Topology, to appear. Also available via anonymous file transfer from math.harvard.edu, user name ftp subdirectory dror. Read the file README first.

J. S. Birman, *New points of view in knot theory*, Bull. Amer. Math. Soc. **28** (1993) 253–287.

V. A. Vassiliev, *Cohomology of knot spaces*, Theory of Singularities and its Applications (Providence) (V. I. Arnold, ed.), Amer. Math. Soc., Providence, 1990.

- **Quantization and invariants of links and 3-manifolds** (Nicolai Reshetikhin)

The lectures will be focused on the relation between quantization (deformation theory) and the theory of invariants of 3-manifolds. In particular, the recent progress in the quantization of the moduli spaces of flat G -bundles over surfaces will be surveyed. The invariants of 3-manifolds related to formal deformations of algebras of functions on simple Lie algebras and corresponding “universal” invariants will be discussed.

- **Spin networks in nonperturbative quantum gravity** (Lee Smolin)

In the last five years it has been discovered that the topology of graphs and knots plays a crucial role in the quantum theory of gravity, when that is developed from a particular point of view known as the loop representation. It turns out that quantum states of the gravitational field are labeled by knot and graph classes. It has also recently been discovered that eigenstates of operators that correspond to geometrical quantities such as areas and volumes of given regions are in fact the same Penrose spin networks that have played an interesting role in topology recently.

This course will be addressed primarily to mathematicians working in knot theory or combinatorics and will aim to explain why and how knot and graph theoretic concepts and problems arise in the quantum theory of general relativity. The emphasis will be on explaining the physical principles that lead to these results as well as on exposing those open issues that might be interesting for mathematicians.

Those wishing an introduction to the material of the course might consult the several reviews of the loops representation and the Ashtekar formalism for general relativity that have been published, including:

[1] Smolin, L., *Recent developments in nonperturbative quantum gravity in quantum gravity and cosmology*, World Scientific, Singapore, 1993.

[2] Rovelli, C., *Classical and Quantum Gravity*, **8** (1991), 1613–1676.

[3] Ashtekar, A., *Non-perturbative canonical gravity*, World Scientific, Singapore, 1991.

The specific material on spin networks to be discussed is described in three preprints by C. Rovelli and L. Smolin, to be distributed on the gr-qc network in September and October 1994.

- **The modern legacies of Thomson’s atomic vortex theory in classical electrodynamics** (Samuel L. Lomonaco)

The physicist William Thomson (also known as Lord Kelvin) proposed in 1867 [26, 27, 28] that physical atoms were knotted vortex tubes in the then postulated all pervasive

fluid called ether. The physicist Peter Guthrie Tait became so enamored with Thomson’s theory that he undertook a study [25] in search of the mathematical properties of knots, thus giving birth to the field of knot theory.

Although scientific evidence has since shown conclusively that physical atoms are by no means knotted fluid vortices in the sense of Thomson, Thomson’s theory has fragmented and relatively recently reemerged in many much more sophisticated forms in both classical and non-classical physics. With the work of Jones, Witten, and others, knot theory has now begun to reassociate on a serious basis with its long lost ancestor, physics [11].

This lecture begins with a survey of the early Thomson atomic vortex theory as it developed within the James Clerk Maxwell milieu [15]. It then focuses on the modern legacies of this theory in classical electrodynamics. Specifically, the lecture focuses on the study of the electro-mechanical behavior of knotted loops of electrical charge and current. Surprisingly, even within classical physics (more specifically, classical electrodynamics), there are many important unresolved questions about such objects. Many of these questions are relevant to such diverse fields as plasma physics, polymer physics, molecular biology.

Next we survey the works of Berger, Field, Freedman, He, Moffatt, and others [1, 2, 4, 5, 6, 16, 17, 18] on knotted tubes of magnetic flux. In regard to such closed knotted magnetic “vortex” tubes, we discuss minimum energy spectra as a function of knot topology, Gaussian linking numbers, asymptotic crossing numbers, and the topological properties of magnetic helicity.

The works of Fukuhara, Freedman, He, Wang, O’Hara, and others [3, 7, 8, 9, 13, 19, 20, 21, 22, 23, 24] on the “energy” of knotted loops carrying a fixed charge are then discussed. In most cases, the “energies” defined and studied in these papers are based on non-physical potentials that (as far as is known by the lecturer) do not arise in electrodynamics. Moreover, from potential theory [12], every charged one-dimensional continuum has infinite classical energy. Nevertheless, these papers are outstanding contributions to knot theory. In regard to these “energies”, we discuss, among other things, the invariance under Mobius inversion of the non-physical $1/r^2$ -“energy” functional, the functional’s relationship with topological crossing number and knot type complexity, and the existence of minimal “energy” knots.

We then focus on a classical electrostatic problem, i.e., the problem of finding the minimal energy geometric positions of knotted closed ε -tubes (i.e., tubes with fixed circular cross section of radius ε) that carry a classical coulomb charge density of fixed total charge. Both perfectly-conducting and non-conducting tubes are considered. A system of differential integral equations that have as solutions all such sufficiently smooth minimal energy knotted closed ε -tubes is then studied.

Finally, the lecture closes with a discussion of the many unresolved problems and questions in classical electrodynamics related to the behavior of knotted loops carrying electrical charge and currents.

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PROCEEDINGS OF SYMPOSIA IN PURE MATHEMATICS

Algebraic Groups and Their Generalizations

William J. Haboush and Brian J. Parshall, Editors

Volume 56

These volumes contain papers based on lectures presented at the conference, "Algebraic Groups and Their Generalizations", held at Pennsylvania State University in July 1991. This conference reflected both the diversification of technique in the classical theory and the beginnings of the study of new objects. These new objects include quantum groups and vertex operator algebras, as well as various kinds of infinite-dimensional groups and algebras inspired by new work in mathematical physics and quantum field theory. The first volume focuses on classical methods, while the second centers on quantum and infinite-dimensional methods. Each section begins with expositions and then turns to new results. This collection provides readers with an excellent introduction to these astonishing new mathematical worlds.

1991 *Mathematics Subject Classification*: 14, 20, 55, 17, 16

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Volume 56

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Editors
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Invited Addresses, Special Sessions, and Contributed Papers

Invited Addresses at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places indicated. For some meetings the list of speakers is incomplete. For full announcements or programs of meetings occurring prior to the first meeting listed below, see the table of contents in this issue. Members wishing to nominate candidates for invited addresses should send relevant information to the associate secretary for the section, who will forward it to the Section Program Committee.

Hartford, CT, March 1995

Ben F. Logan Kari Vilonen
Nina N. Uraltseva Shouwu Zhang

Orlando, FL, March 1995

Dave Benson Krystyna M. Kuperberg
Bjorn Jawerth De Witt L. Sumners

Chicago, IL, March 1995

Rodrigo Banuelos Jeremy T. Teitelbaum
Berit Stenones Efim Zelmanov

Givat Ram, Jerusalem, Israel, May 1995

Shahar Mozes Oded Schramm
Jacob Rubinstein

Boston, MA, October 1995

Kevin D. Corlette Andrei V. Zelevinsky
Daniel S. Freed

Kent, OH, November 1995

Luchezar L. Avramov Peter J. Sternberg
Alice Silverberg Rodolfo H. Torres

Greensboro, NC, November 1995

H. Thomas Banks Bodil Branner
Mladen Bestvina Curtis Greene

Orlando, FL, January 1996

Irving Kaplansky
(Retiring Presidential Address)

Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of the *Notices* went to the printer.

March 1995 Meeting in Hartford, Connecticut

Eastern Section

Associate Secretary: Lesley M. Sibner

Deadline for organizers: Expired

Deadline for consideration: November 9, 1994

William Abikoff, Aras S. Basmajian, and Andrew H. Haas,
Geometric function theory

David A. Cox, *Enumerative geometry, toric varieties, and mirror symmetry*

Sarah Glaz and Evan G. Houston, *Commutative algebra*

Joe McKenna and Alan C. Lazer, *Nonlinear boundary value problems*

Ivan Mirkovic and Kari Vilonen, *Geometric methods in representation theory*

Michael D. Rice, *Cayley graphs and computation*

Steven Rosenberg, *Geometric methods in mathematical physics*

Cesar E. Silva, *Ergodic theory*

Alexander A. Voronov, *Moduli spaces, operads, and representation theory*

March 1995 Meeting in Orlando, Florida

Southeastern Section

Associate Secretary: Robert J. Daverman

Deadline for organizers: Expired

Deadline for consideration: November 9, 1994

Marcy Barge, *The geometry of dynamical systems*

Dave Benson and Clarence W. Wilkerson, *Classifying spaces and cohomology of groups*

Philip L. Bowers, *Discrete conformal geometry*

Robert C. Brigham and Richard P. Vitray, *Combinatorics and graph theory*

John R. Cannon, *Inverse and ill-posed problems*

Bettye Anne Case, Jean Larson, and Joe L. Mott, *Future directions for the mathematics doctorate*

S. Roy Choudhury, *Nonlinear dynamical systems, chaos, and turbulence*

S. Roy Choudhury and Lokenath Debnath, *Solitons and nonlinear waves*

Chat Yin Ho, Alexandre Turull, and Helmut Voelkein, *Finite groups and related topics*

Sam Huckaba and Bernard L. Johnston, *Commutative algebra*

Xin Li and Ram N. Mohapatra, *Approximation theory and special functions*
 Piotr Mikusinski, *New trends in generalized functions*
 De Witt L. Sumners, *Scientific applications of geometry and topology*
 Wim F. Sweldens, *Wavelets for PDEs and integral equations*
 Ahmed I. Zayed, *Sampling theory, wavelets, and signal processing*

March 1995 Meeting in Chicago, Illinois

Central Section
 Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: December 19, 1994

Nigel Boston and Jeremy T. Teitelbaum, *Arithmetic geometry*
 Richard A. Brualdi, Cary Huffman, and Vera S. Pless, *Codes and their applications*
 Theodore A. Burton, *Periodic and almost periodic solutions of differential and functional equations*
 William Chin and Ian M. Musson, *Hopf algebras and quantum groups*
 Carl C. Cowen, *Research in mathematics by undergraduates*
 Stephen R. Doty, Daniel K. Nakano, and Karl M. Peters, *Lie theory*
 Roger L. Jones, *Ergodic theory*
 Richard J. Maher, *Mathematics education reform*
 Eric F. Rieders and Gang Wang, *Probability and harmonic analysis*
 Jacob Towber, *Three manifolds, six j symbols, and coherent tensor operators*
 Mary H. Wright, *Rings and modules*

May 1995 Meeting in Givat Ram, Jerusalem, Israel

Joint Meeting with the Israel Mathematical Union
 Associate Secretary: Lance W. Small
Deadline for organizers: Expired
Deadline for consideration: January 19, 1995

Jonathan S. B. Aaronson, *Ergodic theory*
 Noga Alon and Richard Pollack, *Combinatorics*
 Josef Bernstein and Mina Teicher, *Geometry and topology*
 Joan S. Birman and Mina Teicher, *Braid groups*
 Gregory L. Cherlin and Saharon Shelah, *Logic*
 Hershel M. Farkas and Irwin Kra, *Complex analysis*
 Amos Fiat, Shafi Goldwasser, Seffi Naor, Noam Nissan, and Avi Wigderson, *Theoretical computer sciences*
 Gregory A. Freiman and Melvyn B. Nathanson, *Additive number theory*
 Stephen S. Gelbart, *Automorphic forms*
 Israel C. Gohberg and Henry J. Landau, *Operator theory and applications*
 Sergiu Hart, *Game theory and mathematical economics*
 Kenneth J. Hochberg, *Probability theory*
 Moshe Jarden and Helmut Voelklein, *Field arithmetic*
 William B. Johnson and Gideon Schechtman, *Functional analysis*
 Yuri Kifer, Daniel W. Stroock, and Ofer Zeitouni, *Stochastic dynamics*
 Dany Leviatan and Edward B. Saff, *Approximation theory*

Alexander Lubotzky and Andy R. Magid, *Group theory*
 Victor J. Mizel and Simeon Reich, *Optimization and nonlinear analysis*
 Susan Montgomery and Louis Halle Rowen, *Associative algebra*
 Eitan Tadmor, *Partial differential equations*
 Shlomo M. Vinner, *Mathematical education*
 Zeev Schuss, *Applied mathematics*

August 1995 Mathfest in Burlington, Vermont

Associate Secretary: Robert J. Daverman
Deadline for organizers: November 4, 1994
Deadline for consideration: April 27, 1995

October 1995 Meeting in Boston, Massachusetts

Eastern Section
 Associate Secretary: Lesley M. Sibner
Deadline for organizers: January 6, 1995
Deadline for consideration: July 3, 1995

Kevin D. Corlette, *Title to be announced*
 Stanley J. Eigen and Vidhu S. Prasad, *Ergodic theory*
 Sergey Fomin, Richard P. Stanley, and Andrei V. Zelevinsky, *Representation theory and combinatorics*
 Daniel S. Freed, *Geometry, topology, and quantum field theory*

November 1995 Meeting in Kent, Ohio

Central Section
 Associate Secretary: Andy R. Magid
Deadline for organizers: February 4, 1995
Deadline for consideration: July 25, 1995

Johnnie W. Baker and Meera Sitharam, *Foundations and mathematical aspects of computer science*
 Stephen M. Gagola and Donald L. White, *Representation theory of finite groups and related topics*

November 1995 Meeting in Guanajuato, Mexico

Joint Meeting with the Sociedad Matematica Mexicana
 Associate Secretary: Lesley M. Sibner
Deadline for organizers: March 1, 1995
Deadline for consideration: To be announced

November 1995 Meeting in Greensboro, North Carolina

Southeastern Section
 Associate Secretary: Robert J. Daverman
Deadline for organizers: February 17, 1995
Deadline for consideration: July 25, 1995

January 1996 Meeting in Orlando, Florida

Associate Secretary: Lance W. Small
Deadline for organizers: April 12, 1995
Deadline for consideration: To be announced

March 1996 Meeting in Iowa City, Iowa

Central Section
 Associate Secretary: Andy R. Magid
Deadline for organizers: June 22, 1995
Deadline for consideration: To be announced

Daniel D. Anderson, *Commutative ring theory*
 Tuong Ton-That, *Group representations and mathematical physics*

Meetings

April 1996 Meeting in New York, New York

Eastern Section
Associate Secretary: Lesley M. Sibner
Deadline for organizers: July 13, 1995
Deadline for consideration: To be announced

April 1996 Meeting in Baton Rouge, Louisiana

Southeastern Section
Associate Secretary: Robert J. Daverman
Deadline for organizers: July 19, 1995
Deadline for consideration: To be announced

October 1996 Meeting in Lawrenceville, New Jersey

Eastern Section
Associate Secretary: Lesley M. Sibner
Deadline for organizers: January 5, 1996
Deadline for consideration: To be announced

November 1996 Meeting in Columbia, Missouri

Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: February 1, 1996
Deadline for consideration: To be announced

Mark S. Ashbaugh, *Partial differential equations and mathematical physics*

Nakhle Habib Asmar and Stephen J. Montgomery-Smith, *Harmonic analysis and probability*

John K. Beem and Adam D. Helfer, *Differential geometry*

Z. Q. Chen and Zhongxin Zhao, *Stochastic analysis*

Carmen C. Chicone and Yuri Latushkin, *Differential equations and dynamical systems*

Steven Dale Cutkosky and Hema Srinivasan, *Commutative algebra*

Fritz Gesztesy, *Spectral theory and completely integrable systems*

Jan Segert and Shuguang Wang, *Gauge theory and its interaction with holomorphic and symplectic geometry*

January 1997 Meeting in San Diego, California

Associate Secretary: Lesley M. Sibner
Deadline for organizers: April 8, 1996
Deadline for consideration: To be announced

January 1998 Meeting in Baltimore, Maryland

Associate Secretary: Robert J. Daverman
Deadline for organizers: April 10, 1997
Deadline for consideration: To be announced

March 1998 Meeting in Manhattan, Kansas

Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: June 26, 1997
Deadline for consideration: To be announced

Information for Organizers

Potential organizers should refer to the January issue of the *Notices* for guidelines on organizing a session. Proposals for any of the meetings mentioned in the preceding section should be sent to the cognizant associate secretary by the deadline indicated. No Special Sessions can be approved too late to

provide adequate advance notice to members who wish to participate.

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Other Information

General information for speakers as well as information on site selection for Sectional Meetings can be found in the January issue of the *Notices*. Electronic submission of abstracts is available to those who use the \TeX typesetting system. To obtain the envelopes for electronic abstracts from e-MATH via e-mail, follow these instructions:

1. Type telnet e-math.ams.org.
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4. In the Main Menu, select Gopher.
5. In Gopher, select Meetings and Conferences.
6. In Meetings and Conferences, select Abstracts, then the type of \TeX macro package needed.

Users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to Electronic Abstracts, AMS Meetings Department, P.O. Box 6887, Providence, RI 02940. When requesting the abstracts package, be sure to specify either the plain \TeX , $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\text{\TeX}$, or the \LaTeX package. Requests for general information concerning abstracts may be sent to abs-misc@math.ams.org. Completed electronic abstracts should be submitted to abs-submit@math.ams.org.

Joint Summer Research Conferences in the Mathematical Sciences

University of Washington, Seattle, Washington, June 25 to July 27, 1995

The 1995 Joint Summer Research Conferences in the Mathematical Sciences will be held at University of Washington, Seattle, Washington, June 25 to July 27, 1995. It is anticipated that the series of conferences will be supported by grants from the National Science Foundation and other agencies.

There will be seven conferences in seven different areas of mathematics. The topics and organizers for the conferences were selected by the AMS, the Institute of Mathematical Statistics (IMS), and the Society for Industrial and Applied Mathematics (SIAM) Committee on Joint Summer Research Conferences in the Mathematical Sciences. The selections were based on suggestions made by the members of the committee and individuals submitting proposals. The committee considered it important that the conferences represent diverse areas of mathematical activity, with emphasis on areas currently especially active, and careful attention paid to subjects in which there is important interdisciplinary activity at present.

The Joint Summer Research Conferences are intended to complement the Society's program of annual Summer Institutes and Summer Seminars, which have a larger attendance and are substantially broader in scope. The conferences are research conferences and are not intended to provide an entree to a field in which a participant has not already worked.

It is expected that funding will be available for a limited number of participants in each conference. In addition to those funded, others will be welcome, within the limitations of the facilities of the campus. In the spring a brochure of information will be mailed to all who are requesting to attend the conferences. The brochure will include information on room and board rates, the residence and dining hall facilities, travel, local information, and a Residence Housing Form to request on-campus accommodations. Information on off-campus housing will also be included in the brochure. Participants will be responsible for making their own housing and travel arrangements. Each participant will be required to pay a conference fee.

Those interested in attending one of the conferences should send the following information to the Summer Research Conference Coordinator, Conferences Department, American Mathematical Society, Post Office Box 6887, Providence, RI 02940; fax: 401-455-4004; e-mail: wsd@math.ams.org.

Please type or print the following:

1. Title and dates of conference desired
2. Full name
3. Mailing address
4. Telephone number and area code for office and home, e-mail address, fax number
5. A short paragraph describing your scientific background relevant to the topic of the conference
6. Financial assistance requested; please estimate cost of travel
7. Indicate if support is not required and if interested in attending even if support is not offered

The deadline for receipt of requests for information is March 1, 1995. After the deadline of March 1 requests to attend will be forwarded to the Organizing Committee for each conference for consideration. All applicants will receive a formal invitation, Brochure of Information, notification of financial assistance, and a tentative scientific program (if the chair has prepared one in advance; otherwise, programs will be distributed at on-site registration) from the AMS by May 1. Funds available for these conferences are limited, and individuals who can obtain support from other sources should do so. The allocation of grant funds is administered by the AMS office, and the logistical planning for the conferences is also done by the AMS. However, it is the responsibility of the chair of the Organizing Committee of each conference to determine the amount of support participants will be awarded. This decision is **not** made by the AMS. Women and minorities are encouraged to apply and participate in these conferences.

Any questions concerning the scientific portion of the conference should be directed to the chair or any member of the Organizing Committee.

The Joint Summer Research Conferences in the Mathematical Sciences are under the direction of the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. The following committee members chose the topics for the 1995 conferences: Fan R. K. Chung, Leonard Evens, Alan F. Karr, Peter W. K. Li, Bart Ng, Stewart B. Priddy, Robert J. Serfling, Michael Shub, William E. Strawderman, and Sue Whitesides.

***N.B.* Lectures begin on Sunday morning and run through Thursday. Check in for housing begins on Saturday. No lectures are held on Saturday.**

Sunday, June 25, to Thursday, June 29

Smooth dynamical systems and dimension theory

YAKOV B. PESIN (Pennsylvania State University), cochair
 HOWARD WEISS (Pennsylvania State University), cochair

It is now well accepted that dimension is a fundamental object of study in dynamical systems and that it characterizes, in an essential way, the instability of trajectories and their stochastic behavior. The study of dimension has become enormously popular in the applied sciences because it produces new insights into many physical phenomena. This interaction with the physical sciences has produced many notions of dimensions of invariant sets and invariant measures supported on them. They include Hausdorff dimension, box dimension, information dimension, pointwise dimension, correlation dimension, packing dimension, etc. Many experts believe that, although they are generically distinct, for *sufficiently nice* dynamical systems, these numbers all coincide. The common value captures refined information about the system, and a major goal is to discover relationships between this dimension and other well-known invariants, including entropies, Lyapunov exponents, etc.

This conference will bring together mathematicians, applied mathematicians, and other scientists interested in the mathematical aspects of dimension theory in dynamical systems. Topics of discussion will include: relations between dimension and chaotic behavior of dynamical systems, dimensions of hyperbolic sets and attractors, progress in Eckmann-Ruelle conjecture, number of deterministic and random Cantor-like sets and symbolic dynamics, and estimation of dimensions from experimental data.

We also plan to have several talks on applications of dimension theory and fractal geometry to problems in science and engineering.

Sunday, June 25, to Thursday, June 29

Hamiltonian dynamics and celestial mechanics

DONALD G. SAARI (Northwestern University), cochair
 ZHIHONG (JEFF) XIA (Georgia Tech), cochair

Sunday, July 2, to Thursday, July 6

Matroid theory

JOSEPH E. BONIN (The George Washington University), cochair
 BRIGITTE SERVATIUS (Worcester Polytechnic Institute), cochair

Matroid theory started sixty years ago with Hassler Whitney's paper *On the abstract properties of linear dependence*. Not only did Whitney abstract the common thread of independence found in numerous parts of mathematics (including linear algebra and graph theory), but he also showed how some notions from one or more of these particular areas carry over to and shed light on matroids in general. The

two-way interplay between matroid theory and its many fields of application yields a rich theory with powerful applications.

This conference will focus on four areas of active research in matroid theory and its applications.

The Critical Problem: What is the least number of affine matroids into which a given representable matroid can be partitioned? This problem, which can be answered in terms of the characteristic polynomial, forms the theoretical framework for numerous important problems, including Tutte's 5-flow conjecture and Hadwiger's conjecture. Work in this area includes the study of characteristic polynomials of matroids per se and extremal matroid problems motivated by the critical problem.

Structure Theory & Connectivity: Minor-closed classes of matroids may be characterized by their excluded minors, as in Tutte's characterization of graphic matroids. Alternatively, one can begin with an antichain of minors and try to describe the class of matroids with these minors excluded. Much current work aims to determine the structure of such classes, using the notion of 3-connectivity and such tools as the Splitter Theorem. Other recent work may have implications for Rota's conjecture that the set of excluded-minors for $GF(q)$ -representability is finite.

Oriented Matroids & Arrangements of Hyperplanes: Oriented matroids encode, in addition to independence, the orientation of the elements. In recent years oriented matroids have found numerous deep applications. Oriented matroid tools encode the topology of complex hyperplane arrangements and of subspace arrangements. Major recent progress includes a counterexample to Saito's conjecture and a counterexample to the claim that the homotopy type of the complement of a complex arrangement is determined by its matroid.

Rigidity of Bar & Joint Frameworks: Distinguishing between rigid and nonrigid frameworks is the fundamental problem of rigidity theory. This may be translated into the question of the rank of the rigidity matroid. Only in dimensions one and two has a separation of the combinatorial and geometric aspects of rigidity been achieved. The problem of characterizing generic rigidity combinatorially for dimensions three and higher is the subject of much current research.

Sunday, July 9, to Thursday, July 13

Linear and nonlinear CG-related methods

LOYCE ADAMS (University of Washington), cochair
 JOHN L. NAZARETH (Washington State University), cochair

The conference will seek to bring together leading researchers and practitioners in computational linear algebra and computational optimization, as well as younger postdocs and advanced graduate students, in order to foster communication and promote synergistic connections between linear and nonlinear CG-related research (and its application).

"Conjugate gradient-related" is used generically to denote an important class of iterative methods requiring limited computer storage. They are designed to solve large-scale

or high-dimensional problems involving a finite number of variables: in particular, systems of linear equations, linear least-squares problems, nonlinear optimization and least-squares problems, and systems of nonlinear equations. Such problems are central to scientific computation. A particularly rich source arises from the discretization in various ways of infinite-dimensional problems: for example, systems of ordinary and partial differential equations, variational problems and optimal control problems.

Linear CG-related methods are techniques of computational linear algebra; nonlinear CG-related methods are techniques of computational optimization. The two areas share a broad common frontier, and one of the most easily traversed crossing points is via the following simple observation: solving a positive definite symmetric system of linear equations is equivalent to minimizing a strictly convex quadratic functional. This equivalence helped enrich early algorithmic advances in both subjects, facilitating in particular the original discovery of the conjugate gradient method by Hestenes and Stiefel in 1952 and its adaptation to nonlinear optimization by Fletcher and Reeves in 1964, which gave rise to a very active research area of computational mathematics.

There has been an increasing divergence between researchers in CG-related methods for linear systems and CG-related methods for nonlinear optimization, and the two research communities are sometimes surprisingly isolated from one another, to the detriment of both. On the computational linear algebra side, we have CG/GMRES/Lanczos/... , with an emphasis on preconditioning techniques and error analysis. On the computational optimization side, we have CG/Limited-Memory-QN/Truncated-Newton and QN/... , with an emphasis on convergence analysis and implementation strategies. Both communities have a great deal to learn from one another. For instance: a) The reformulation of the standard CG algorithm as a limited-memory QN algorithm, now well developed in nonlinear optimization, may have interesting stability properties when used to solve linear systems. b) The use of appropriately preconditioned CG algorithms that exploit problem structure holds a key to effective implementation of new interior-point methods of linear and nonlinear programming. c) A thorny problem in optimization is the question of accuracy of gradient information, an issue that can be clarified in the light of existing linear CG knowledge. Many other examples of this type can be cited, and they provide an organizing focus and theme for the conference.

Sunday, July 16, to Thursday, July 20

Finsler geometry

SHIING-SHEN CHERN (MSRI, Berkeley), chair

DAVID BAO (University of Houston-University Park),
cochair

ZONGMIN SHEN (Indiana University-Purdue University,
Indianapolis), cochair

Finsler geometry is a metric generalization of Riemannian geometry and is a comparatively young branch of differential

geometry. Although Finsler geometry had its genesis in Riemann's 1854 "Habilitationsvortrag", its systematic study was not initiated until 1918 by Finsler, and the fundamentals were not completely formulated until the mid-thirties. Later on, however, the field underwent rapid development by mathematicians and physicists of many countries.

The geometrical picture of a Finsler manifold—as a "smooth" metric space—is structurally richer than that of a Riemannian manifold and presents challenges in the formulation of global results. Recent studies also show that Finsler geometry has many applications, including: complex analysis, control theory, certain predator-prey models, coral reef ecology, optics, thermodynamics, and gauge theory.

The purpose of the conference is to gather together some of the researchers in this field, as well as some newcomers, in a surrounding that will hopefully foster constructive criticism and knowledge transfer. There will be reports of recent developments and clarifications of main directions for future research.

The following is a tentative list of topics to be included: comparison theorems, Finsler spaces with special curvature properties, integral geometry in Minkowski spaces, Gauss-Bonnet type results, the Kobayashi metric; complex Finsler geometry, control theory, indefinite Finsler metrics on spacetime, Finslerian biology and physics.

Sunday, July 23, to Thursday, July 27

Analysis of multi-fluid flows and interfacial instabilities

YURIKO YAMAMURO RENARDY (Virginia Polytechnic
Institute and State University), chair

DEMETRIUS PAPAGEORGIOU (New Jersey Institute of
Technology), cochair

SHU-MING SUN (Virginia Polytechnic Institute and State
University), cochair

DANIEL D. JOSEPH (University of Minnesota), cochair

An interaction of mathematical and experimental analyses has contributed to the recent evolution of modern materials. Products such as bicomponent nylons and photographic films typically involve flows of more than one fluid and the presence of interfaces and free surfaces. The main mathematical developments have concerned the derivation and analysis of model equations, the study and application of constitutive models for polymeric liquids, analysis of bifurcating solutions, and numerical simulations. The emphasis of our conference is on the exchange of mathematical ideas and the discussions of new methods and results in progress.

Many configurations are possible for the interface between immiscible liquids used in the production of composite materials; examples include layers, bubbles, and emulsions. These structures are often different from the initial configurations from which they arise. In order to control and use these materials, we must describe the geometric form of the interface between the constituent fluids. One way to view the problem of preferential positioning and shaping of the interface is to address interfacial stability. Results from perturbation theory,

applications of the center manifold theorem, and variational methods have shed some light. The analysis of waves on the interface leads to the study of amplitude evolution equations, including those of Ginzburg-Landau type and the Kuramoto-Sivashinsky equation; related reaction-diffusion equations; and computational results on periodic, quasi-periodic, and chaotic solutions.

Stratified flows composed of liquids that exhibit non-Newtonian or viscoelastic properties occur in many industrial processes. The modeling of these flows is complicated by the question of how to incorporate the elastic and viscous properties of the liquids. There are constitutive models which lead to smoothing of discontinuities, or on the other hand to hyperbolicity in the dynamics of the flow, to steady flows of transonic type and ill-posed problems. Questions of existence and uniqueness of solutions for model equations, inflow and outflow boundary conditions, and the properties of the solutions are being resolved with tools from the theory of partial differential equations.

The effects of dissolved additives and temperature gradients are important in many processes. Model problems often take advantage of geometric symmetries. The reduction

of the partial differential equations and boundary conditions to ordinary differential equations, the use of normal forms, and a group theoretic approach have yielded new classes of qualitatively different solutions. Pattern selection problems arise in the context.

The conference brings together mathematicians, physicists, and engineers who will address multifluid dynamics and numerical simulation of composite materials.

Sunday, July 23, to Thursday, July 27

Electrical impedance tomography

JOHN SYLVESTER (University of Washington), cochair

GUNTHER UHLMANN (University of Washington), cochair

MICHAEL VOGELIUS (Rutgers University), cochair

The purpose of the conference is to bring together an international group of mathematicians (and even some physicists and engineers) for a systematic study of *Electrical impedance tomography* which provides a noninvasive technology for determining the electromagnetic properties of a medium from current and voltage measurements made at the boundary.



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1995 Summer Research Institute

Algebraic Geometry

University of California, Santa Cruz, July 9–29, 1995

The forty-second Summer Research Institute sponsored by the American Mathematical Society will be devoted to algebraic geometry and will be held at the University of California, Santa Cruz, from July 9–29, 1995. The members of the Organizing Committee are **Henri Gillet**, University of Illinois at Chicago; **János Kollár**, University of Utah; **Robert Lazarsfeld** (chair), University of California, Los Angeles; **Robert MacPherson**, Institute for Advanced Study; **David Morrison**, Duke University; and **Y.-T. Siu**, Harvard University.

It is anticipated that the institute will be partially supported by a grant from the National Science Foundation. Proceedings of the institute will be published in the series *Proceedings of Symposia in Pure Mathematics*.

The topic was chosen by the 1993 AMS Committee on Summer Institutes and Special Symposia, whose members at the time were: Donald Burkholder, Craig Evans, Melvin Hochster, Nicholas Katz, Brian Parshall (chair), Francois Treves, and Edward Witten.

In recent years many exciting new frontiers have opened up in algebraic geometry. The organizers plan to sponsor six introductory lecture series of a week's duration, geared towards geometrically oriented algebraic geometers, in the following areas:

1. Arithmetic questions
2. Motives
3. Higher dimensional geometry
4. Complex analytic methods
5. Hodge theory and fundamental groups
6. Ideas from physics

These plenary lectures will occupy the morning hours. Parallel seminars in the afternoon will be organized covering these as well as many of the traditional areas in the field (e.g., curves, surfaces, vector bundles, singularities, algebraic cycles, computational questions, and characteristic p geometry). There is also the anticipation of running a few small "mini-courses" on fields (such as symplectic geometry) that share borders with algebraic geometry. In addition, as in previous institutes, the organizers will encourage self-organized activities on the part of the participants.

Since it is likely that not all participants will attend for the entire three-week period, there will be considerable effort to schedule the lectures and seminars as coherently as possible.

In particular, the sessions will be paired up, with sessions 1 and 2 during week one, sessions 3 and 4 during week two, and sessions 5 and 6 during week three. A more precise schedule will be announced in the near future.

All mathematicians with an interest in algebraic geometry are welcome to attend. Funding is limited, and support will primarily be given for travel and subsistence to young researchers (especially those away from the major centers), women, minorities, and other underrepresented groups.

Those interested in receiving an invitation should send the following information to: Christopher Harkness, Summer Institute Coordinator, American Mathematical Society, P.O. Box 6887, Providence, RI 02940-6887, or through e-mail: chh@math.ams.org, **prior to MARCH 15, 1995**.

Please type or print the following:

1. Full name
2. Mailing address
3. Area code and phone number for office and home, FAX number, and e-mail address
4. Which week or weeks you wish to attend
5. Scientific background relevant to the institute topic
6. Financial assistance requested (or indicate if no support is required)

Please note that **all** potential participants, whether or not requesting support, should solicit an invitation from the AMS by the indicated deadline. These requests will be forwarded to the Organizing Committee, and the AMS will send formal invitations, indicating support amounts (if awarded), in late April of 1995.

Information on housing, dining, travel, and the local area will be sent to participants along with the invitation letters. Participants will be required to pay a small conference fee. Questions concerning the scientific program can be addressed to Rob Lazarsfeld by e-mail: algeom95@math.ucla.edu or any of the organizers. Questions of a nonscientific nature should be directed to the summer institute coordinator, Chris Harkness, through the address provided above.

AMS-SIAM Summer Seminar in Applied Mathematics

Mathematics of Numerical Analysis: Real Number Algorithms

Park City, Utah, July 17–August 11, 1995

The twenty-fifth AMS-SIAM Summer Seminar in Applied Mathematics will be held July 17–August 11, 1995, at the Prospector Square Inn and Conference Center, Park City, Utah. The seminar will be sponsored by the American Mathematical Society, the Society for Industrial and Applied Mathematics, and the International Mathematical Union. It is anticipated that the seminar will be partially supported by grants from federal agencies. The proceedings will be published by the AMS in the *Lectures in Applied Mathematics* series.

The mathematical theory of real number algorithms is to be the subject of this proposed conference. Thus numerical analysis will be central with emphasis on geometrical, algebraic, analytic, and foundational perspectives. Investigations of efficiency will play a special role. Practical algorithms will be the subject of theoretical analysis, but immediate useful results will not be demanded.

It is hoped that the conference will give the subject of numerical analysis a greater coherence through a focus on the mathematical side—in particular, to aim to strengthen the unity of mathematics and numerical analysis and to narrow the gap between pure and applied mathematics. That goal is appropriate, since many of the heroes of pure and applied mathematics—Newton, Euler, Lagrange, and Gauss among them—established the basic real number algorithms. With the revolution of the computer and the great achievements of scientific computation, it does service to both the pure and applied communities to support the mathematical development of numerical analysis.

This is an appropriate time to schedule such a meeting in view of the rapid development of heuristic work, a good base of theoretical work, and a widespread desire for mathematical deepening of the subject.

The conference will be international in character with strong representation from the most mathematically developed parts of numerical analysis. Besides tutorials and short courses, seminars in the following areas are contemplated: linear algebra, nonlinear systems-path following, differential equations, linear programming problems, algebraic questions, foundations, information-based complexity, lower bounds, and approximation theory.

The organizing committee includes:

Eugene L. Allgower, Colorado State University;

Lenore Blum, MSRI;

Alexandre J. Chorin, University of California, Berkeley;

Philippe G. Ciarlet, Université Pierre et Marie Curie, Paris;

Felipe Cucker, Universitat Pampeu Fabra, Spain;

James W. Demmel, University of California, Berkeley;

Ronald A. DeVore, University of South Carolina, Columbia;

Gene H. Golub, Stanford University;

Arieh Iserles, University of Cambridge, UK;

Hubertus Th. Jongen, Reinisch-Westf Tech Hochschule, Aachen, Germany;

Herb Keller, California Institute of Technology;

Jacques Louis Lions, College de France;

James M. Renegar, Cornell University;

Michael Shub, IBM;

Steve Smale (chair), University of California, Berkeley;

Gilbert Strang, MIT;

Shmuel Winograd, IBM; and

Henryk Wozniakowski, University of Warsaw and Columbia University.

To date the following have accepted invitations to speak:

all members of the organizing committee;

Roger Brockett, Harvard University;

John Canny, University of California, Berkeley;

W. Dahmen, Reinisch-Westf Tech Hochschule, Aachen, Germany;

David Donoho, University of California, Berkeley;

James G. Glimm, SUNY at Stony Brook;

Dima Y. Grigoriev, Pennsylvania State University (tentative);

N. Karmarker, AT&T Bell Laboratories;

T. Y. Li, Michigan State University;

Arkadi Nemirovski, Israel Institute of Technology;

Victor Pan, Herbert H. Lehman College, CUNY;

Michael J. Powell, University of Cambridge, England;

Vladimir Rokhlin, Yale University;

Marie-Françoise Roy, Université de Rennes;

Roger Temam, Indiana University;

Richard S. Varga, Kent State University;

Victor A. V. Vassiliev, Institute for System Studies, Moscow;

Margaret H. Wright, AT&T Bell Laboratories; and

Yosef Yomdin, Weizmann Institute of Science, Israel.

Park City is a popular summer vacation destination with a comfortable, temperate climate in the mountains of Utah. Housing for participants has been arranged at the Inn at Prospector Square and Conference Center. Reasonably priced restaurants, food shops, and other attractions are within walking distance of the Inn. The Inn at Prospector Square includes nine buildings with newly remodeled accommodations in addition to a large lecture hall and meeting rooms. A sports center including pool, exercise machines, racquetball courts, etc. (all available for a nominal fee), is located on the property. All rooms being held for participants contain one or two queen-sized beds, television, telephone, coffee maker, mi-

crowave oven, and refrigerator. Some units have full kitchens. The daily cost is \$45 single or double occupancy (\$50 triple and \$55 quad) plus 10.13% lodging tax. Note that these prices are per room, not per person. For those attending the full four weeks of the seminar, a very limited number of one-, two-, and three-bedroom condominium units is available on a monthly basis. Those interested should contact the conference coordinator. More detailed information, including how to make reservations, will be included with the official invitation to the seminar.

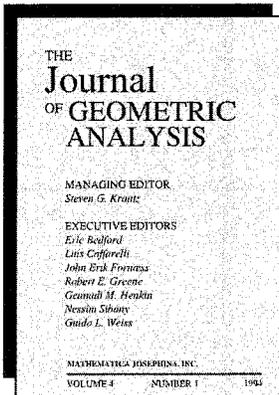
There is a registration fee of \$40. Everyone interested in receiving an invitation to attend should send the following information **before February 15, 1995**, to AMS-Summer Seminar Conference Coordinator, AMS Meetings and Conferences Department, P.O. Box 6887, Providence, RI 02940; e-mail dls@math.ams.org. Please type or print the following:

1. Full name and mailing address.
2. Telephone number and area code for office and home.

3. E-mail address if available.
4. Anticipated arrival and departure dates;
5. Your scientific background relevant to the topic of the seminar; please indicate if you are a student or if you received your Ph.D. on or after 7/1/89.
6. Financial assistance requested (please estimate cost of travel); indicate if support is not required and if interested in attending even if support is not offered.
7. Indicate if you would like to be included on a list of those desiring a roommate for the seminar. If yes, please indicate if you are male or female and list any other pertinent information (e.g., smoking/nonsmoking).

Special encouragement is extended to junior scientists to apply. A special pool of funds expected from federal agencies has been earmarked for this group. Other participants who wish to apply for a grant-in-aid should so indicate; however, funds available for the seminar are very limited, and individuals who can obtain support from other sources should do so. Advanced graduate students are encouraged to participate.

New Journal for the American Mathematical Society!



The Journal of Geometric Analysis

Volume 5, 1995

The *Journal of Geometric Analysis* is a forum for the best work in the field of geometric analysis. This journal publishes work which most clearly exhibits the symbiotic relationship among techniques of analysis, geometry, and partial differential equations. The *Journal of Geometric Analysis* is committed to being the journal of record for important new results that develop the interaction between analysis and geometry. It has established and will maintain the highest standards of innovation and quality in the field.

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Formerly published by CRC Press, Inc., the *Journal of Geometric Analysis* is now published by Mathematica Josephina, Inc., and is printed and distributed by the American Mathematical Society. Starting with the 1994 volume (Volume 4), the journal will be published quarterly.

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Winter Meeting of the Canadian Mathematical Society

December 11–13, 1994

Tentative Program

The Canadian Mathematical Society and McGill University cordially invite mathematicians to the 1994 Winter Meeting of the Society. The entire program will take place at the Meridien Hotel, located in the heart of Montréal, Québec, from Sunday, December 11, to Tuesday, December 13, 1994.

Plenary Speakers

Charles Herbert Clemens, University of Utah, *Mathematicians and current trends in math education: Are our worries legitimate?*, Monday, 9:00 a.m. to 10:00 a.m.;

Alexander Ioffe, University of Technion (Israel), *Variational methods in nonsmooth global analysis*, Tuesday, 9:00 a.m. to 10:00 a.m.;

André Joyal, Université du Québec à Montréal, *New categorical structures in mathematics*, Tuesday, 3:15 p.m. to 4:15 p.m.;

Bernard Malgrange, University of Grenoble, *Connexions méromorphes*, Monday, 2:00 p.m. to 3:00 p.m.;

M. Miyanishi, University of Osaka, *Open algebraic surfaces*, Sunday, 2:00 p.m. to 3:00 p.m.;

Vladimir V. Peller, Kansas State University, *Approximation by operator-valued analytic functions*, Sunday, 9:00 a.m. to 10:00 a.m.; and

Michel Waldschmidt, Paris VI University, *Diophantine approximation of transcendental numbers*, Tuesday, 2:00 p.m. to 3:00 p.m.

The Coxeter-James Lecturer

The Coxeter-James Lecture will be given on Monday from 6:00 p.m. to 7:00 p.m. by **Mark Spivakovsky**, University of Toronto, and is titled *Resolution of singularities*.

Symposia

Symposia in five domains will take place with session organizers and invited speakers as follows:

Algebraic geometry (Sunday morning and afternoon and Monday afternoon), organized by **Peter Russell**, McGill University; James Carrell (UBC), Daniel Daigle (Ottawa), Richard Ganong (York), R. Gurjar (Tata Institute), M. Koras (Warsaw), M. Miyanishi (Osaka), T. Petrie (Rutgers), D. Wright (Washington), M. Zaidenberg (Grenoble), D.Q. Zhang (Singapore), V. Zurkowski (Ottawa).

Classical analysis (Sunday and Tuesday mornings), organized by **Ivo Klemes**, McGill University; Ron C. Blei (Connecticut), John J.F. Fournier (UBC), Kathryn E. Hare (Waterloo), Feodor L. Nazarov (Univ. of St. Petersburg & LOMI), Vladimir V. Peller (Kansas State), Thomas J. Rans-

ford (Laval), Karin Reinhold (Albany), Brent P. Smith (Kansas State), J. Michael Wilson (Vermont).

Dynamical systems and differential equations (Sunday and Monday mornings), organized by **Dana Schlomiuk**, Université de Montréal; Florin N. Diacu (Victoria), C. Chicone (Missouri), J. Guckenheimer (Cornell), Niki Kamran (McGill), William Langford (Guelph), B. Malgrange (Grenoble), Christiane Rousseau (Montréal), M. Singer (North Carolina State).

Nonsmooth analysis (Sunday morning and afternoon and Monday afternoon), organized by **Ron Stern**, Concordia University; Jonathan M. Borwein (SFU), Francis Clarke (Montréal), Jean-Baptiste Hiriart Urruty (U. Paul Sabatier, Toulouse), Alexander Ioffe (Technion, Israel), Yuri S. Ledyayev (Steklov I), Phillip Loewen (UBC), Michael Overton (Courant Institute), René Poliquin (Alberta), R. Tyrrell Rockafellar (Washington at Seattle), Richard V. Vinter (Imperial College), Peter R. Wolenski (Louisiana Southern), Henry Wolkowicz (Waterloo), Jane J. Ye (Victoria).

Transcendence and diophantine geometry (Monday afternoon and Tuesday morning and afternoon), organized by **Damien Roy**, University of Ottawa; Michael A. Bean (Toronto), David W. Boyd (UBC), Henri Darmon (Princeton), Ram P. Murty (McGill), Damien Roy (Ottawa), Alice Silverberg (Ohio-State), Cameron L. Stewart (Waterloo), Michel Waldschmidt (Paris VI).

Education Program

The Mathematics Education Session (Monday morning and Tuesday morning) is being organized by **Georg Schmidt**, McGill University, gschmidt@math.mcgill.ca, and features the plenary lecture by **Charles Herbert Clemens**, University of Utah. The theme for this session will be *The role of mathematics departments in the training of elementary and high school teachers*. Contributions which give an account of what is being done in this regard at your university are welcomed. Such contributions are subject to the rules for contributed papers.

Contributed Papers

Contributed papers of 15-minutes' duration are invited. Instructions and abstract forms will be included in the September issue of the *CMS Notes*. To be eligible to present a contributed paper, ALL abstracts and registration fees must be received in Ottawa before **October 15**.

Those who use the \TeX typesetting system may submit their abstracts electronically. Files should include the speaker's

name, affiliation, complete address, e-mail address, title of talk, and the abstract itself. Files may be sent by e-mail to the abstracts coordinator at clequel@acadvm1.uottawa.ca.

Others should prepare their abstract using the standard CMS form available from the CMS office in Ottawa or in the September 1994 *CMS Notes*. Abstracts should be sent to the Abstracts Coordinator, CMS Executive Office, 577 King Edward, P.O. Box 450, Station A, Ottawa, Ontario, Canada K1N 6N5, so as to arrive by the contributed papers deadline of **October 15**.

Social Events

All delegates are invited to a cash-bar welcoming reception scheduled for Saturday evening from 7:00 p.m. to 8:00 p.m. during evening registration.

A banquet will be held in the ballroom of the Meridien Hotel in downtown Montréal and is scheduled for Monday, December 12, at 7:30 p.m. Delegates are invited to meet at the cash bar, which will be open from 7:00 p.m. to 7:30 p.m. Tickets are available at CDN\$40 each, including all taxes and gratuities, and are included in most registration fee categories. The banquet menu features cold entrées, sautéed chicken grand-mère, buttered fresh noodles, baby peas l'anglaise, decorated cold platters, salads, and a variety of desserts. Kosher or vegetarian meals are available upon advance request. Also included are two bottles of wine for each table (approximately two glasses per person).

During the meeting we invite you to have coffee and chat with colleagues during the scheduled morning and afternoon coffee breaks provided on a complimentary basis.

Preregistration

Payment for preregistration may be made by check or by VISA or MasterCard. Although preregistration fees are given in Canadian dollars, delegates may send checks in U.S. dollars by contacting their financial institution for the current exchange rate. A preregistration form is included in the September *CMS Notes* or may be requested from the CMS executive office at the address above or by telephone (613-564-2223) or fax (613-565-1539).

	Before Oct. 14	After Oct. 14
*CMS/AMS/MAA members with grants	\$185	\$230
*CMS/AMS/MAA members without grants	110	130
*Nonmembers with grants	260	330
*Nonmembers without grants	145	180
Teachers, students, postdocs, retired, unemployed, or Education Session only	60	75
One-day fee	60	75

* Includes banquet on Monday at 7:30 p.m.

Plenary speakers, prize lecturers, and invited special session speakers should register using the special registration

form available from the chair of the Scientific Programme Committee or from a session organizer.

Accommodations

A block of rooms has been reserved at the Meridien Hotel in downtown Montréal at \$99 single/double. Delegates are asked to make their own arrangements directly by **November 1** by telephone (514-285-1450) or by using the Reservation Reply Form included in the September 1994 *CMS Notes*.

Travel

Montréal is served by two international airports: Dorval (514-633-3105), which is located west of the city, and Mirabel (514-476-3010), located to the northwest of Montréal. Airport bus service by Autocar Connaisseur (514-934-1222) is available at both airports. Bus service fares (subject to change) are Dorval-downtown: \$8.50, Mirabel-downtown: \$13.00, and Dorval-Mirabel: \$11.00.

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Acknowledgments

The Scientific Programme Committee wishes to extend its thanks to the Natural Sciences and Engineering Research Council (NSERC) for its generous support of the symposia. Other grants have also been received from McGill University.

The CMS wishes to acknowledge the contribution of the following committees in presenting these exciting scientific, educational, and social programs. We also thank those at the host department who have taken time from their regular duties to help out.

Scientific Programme Committee: Ivo Klemes (McGill); Ram Murty (McGill), *ex officio*; Damien Roy (Ottawa); Peter Russell (McGill); Dana Schlomiuk (Montréal), chair; Nicole Tomczak-Jaegermann (Alberta), *ex officio*; and Graham P. Wright (CMS), *ex officio*.

Education Session: Georg Schmidt (McGill).

Local Arrangements Committee: Monique L. Bouchard (CMS), *ex officio*; Roger Rigelhof (McGill), chair; and Robert Vermes (McGill).

Mathematical Sciences

Meetings and Conferences

1994

1994–1995. **Mittag-Leffler Institute's Academic Program for 1994–1995: Statistical Mechanics and Stochastic Analysis.** Mittag-Leffler Institute, Djursholm, Sweden. (Dec. 1993, p. 1444)

October 1994

15–19. **Workshop on Exterior Differential Systems.** Centre de Recherches Mathématiques, Université de Montréal, Montréal, Canada. (Sept. 1994, p. 843)

16–18. **Women in Probability.** Cornell University, Ithaca, NY. (Apr. 1994, p. 383)

16–22. **Geometrie.** Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

17–18. **1994 Symposium on Volume Visualization.** Sheraton Premiere at Tysons Corner, VA. (May/June 1994, p. 511)

17–21. **Visualization '94 Conference,** Sheraton Premiere at Tysons Corner, VA (Washington, DC area). (May/June 1994, p. 511)

17–21. **IMA Workshop on Wavelets, Multigrid and Other Fast Algorithms (Multipole, FFT), and Their Use in Wave Propagation,** Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 145)

17–21. **Atelier MEDICIS-SMF: methodes algebriques et geometriques pour les systemes differentiels.** CIRM, Marseille, France. (Feb. 1994, p. 145)

20–22. **International Conference on "Systems, Control, Information", Methodologies and Applications,** Wuhan, China. (Sept. 1994, p. 843)

20–24. **First Slovenian Congress of Mathematics,** Cankarjev dom, Ljubljana, Slovenia. (May/June 1994, p. 511)

21. **Women in Mathematics and Computer Science,** Kean College of New Jersey, Union, NJ. (May/June 1994, p. 511)

21–22. **Fourteenth Annual Meeting of the Southeastern-Atlantic Regional Conference on Differential Equations.** University of Tennessee, Knoxville, Tennessee. (Apr. 1994, p. 383)

22. **Mid-Atlantic Probability and Statistics Day,** American University, Washington, DC. (Sept. 1994, p. 843)

22–23. **Northeastern Operator Theory Seminar,** Vassar College, Poughkeepsie, NY. (Jul./Aug. 1994, p. 674)

23–29. **Wahrscheinlichkeitsmaße auf Gruppen und Verwandten Strukturen.** Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

24–26. **International Symposium on Com-**

THIS SECTION contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete listing of meetings of the Society, and of meetings sponsored by the Society, will be found inside the front cover.

AN ANNOUNCEMENT will be published in the *Notices* if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

IN GENERAL, announcements of meetings and conferences held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the *Notices*, care of the American Mathematical Society in Providence, or electronically to notices@math.ams.org.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

EFFECTIVE with the 1990 volume of the *Notices*, the complete list of Mathematical Sciences Meetings and Conferences will be published only in the September issue. In all other issues, only meetings and conferences for the twelve-month period following the month of that issue will appear. As new information is received for meetings and conferences that will occur later than the twelve-month period, it will be announced at the end of the listing in the next possible issue. That information will not be repeated until the date of the meeting or conference falls within the twelve-month period.

putational Molecular Dynamics, University of Minnesota Supercomputer Institute, Minneapolis, Minnesota. (Jul./Aug. 1994, p. 674)

24–November 11. **Fourth Autumn Course on Mathematical Ecology,** Trieste, Italy. (Jan. 1994, p. 58)

25–27. **Thirteenth Symposium on Reliable Distributed Systems,** Near Irvine, California. (Apr. 1994, p. 383)

26–29. **Sixth IEEE Symposium on Parallel and Distributed Processing,** Dallas, Texas. (Mar. 1994, p. 251)

28–29. **1994 Mathematical Sciences Department Chairs Colloquium,** Arlington, Virginia. (Apr. 1994, p. 383)

28–29. **Central Section,** Oklahoma State University, Stillwater, Oklahoma.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

28–30. **Hybrid Systems and Autonomous Control,** Cornell University, Ithaca, NY.

(May/June 1994, p. 511)

30–November 5. **Finite Volume Methods,** Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

31–November 4. **Orthogonality, Moment Problems, and Continued Fractions: An International Conference in Honor of T.J. Stieltjes, Jr. (1856–1894),** Delft, Holland. (Dec. 1993, p. 1453)

31–November 4. **International Conference of the Chilean Computer Science Society,** Concepcion, Chile. (Apr. 1994, p. 383)

November 1994

2–4. **Mathématique Informatique.** CIRM, Marseille, France. (Feb. 1994, p. 145)

4–5. **Ninth Annual Pi Mu Epsilon Regional Undergraduate Mathematics Conference,** St. Norbert College, De Pere, WI. (May/June 1994, p. 512)

7–9. **ISCIS IX (International Symposium on Computer and Information Sciences - 9),**

Antalya, Turkey. (May/June 1994, p. 512)

7–18. **2nd Workshop on Three-dimensional Modelling of Seismic Waves Generation, Propagation, and Their Inversion**, Trieste, Italy. (Feb. 1994, p. 145)

9–10. **IMA Tutorial on Waves in Random and Other Complex Media**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 145)

11–13. **Southeastern Section**, University of Richmond, Richmond, VA.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

12. **Southern California Matrix Theory Conference**, University of Utah, Salt Lake City, Utah. (Jul./Aug. 1994, p. 675)

13–17. **1994 International Symposium on Logic Programming**, MSI, Ithaca, NY. (Jul./Aug. 1993 p. 715)

13–19. **Komplexitätstheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

14–18. **International Conference on Mathematical Ecology**, Trieste, Italy. (Feb. 1994, p. 145)

14–18. **IMA Workshop on Waves in Random and Other Complex Media**. Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 145)

14–18. **Nouvelles Tendances et Approximation**, CIRM, Marseille, France. (Feb. 1994, p. 145)

14–18. **Supercomputing '94, the Seventh Annual High-performance Computing and Communication Conference**, Convention Center, Washington, DC. (Apr. 1994, p. 384)

16–18. **Envirosoft 94 (Development and Application of Computer Techniques to Environmental Studies)**, San Francisco, CA. (May/June 1994, p. 512)

18–20. **Conference in Probability and Modern Analysis**, University of California, Riverside. (Sept. 1994, p. 844)

20–26. **Mathematical Aspects of Computational Fluid Dynamics**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

21–27. **Thanksgiving Workshop on Controlled Topology, Geometry and Algebra**, IMADA, Odense University, Odense, Denmark. (May/June 1994, p. 512)

27–December 3. **The Norbert Wiener Centenary Congress**, Michigan State University, East Lansing, MI (Preliminary Announcement (May/June 1994, p. 512)

27–December 3. **Mathematical Models for Infectious Diseases**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

December 1994

*2–4. **Mathematica in the "Gunks"**, State Univ. of New York, College at New Paltz.

PROGRAM: This is a three-day course to develop *Mathematica* skills, given by Stan Wagon.

INFORMATION: K. Heiner; tel: 914-257-2938; electronic mail: heinerk@matrix.newpaltz.edu.

4–10. **Applied Probability**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

5–9. **20th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**, Auckland, New Zealand. (Apr. 1994, p. 384)

8–9. **Workshop on Mobile Computing Systems and Applications**, Santa Cruz, CA. (Jul./Aug. 1994, p. 675)

*11–13. **Winter Meeting of the Canadian Mathematical Society**, Montréal, Québec, Canada.

INFORMATION: See Meetings Section page 1021 for details and information.

12–14. **SIAM Conference on Inverse Problems**, Fish Camp, CA. (Dec. 1993, p. 1453)

12–16. **International Conference on Set-theoretic Topology and its Applications**, Ehime University, Matsuyama, Japan. (May/June 1994, p. 513 and Sept. 1994, p. 844)

12–17. **International Conference on Operator Theory for Complex and Hypercomplex Analysis**, Mexico City, Mexico. (May/June 1994, p. 513)

12–17. **Pacific Rim Geometry Conference**, National University of Singapore, Republic of Singapore. (Feb. 1994, p. 146)

14–16. **New Asymptotic Methods in Geophysical Flows**, Cambridge, U.K. (Sept. 1994, p. 844)

16–19. **International Symposium on Methods and Applications of Analysis**, Hong Kong. (Mar. 1994, p. 251)

18–23. **Asymptotik Hochdimensionaler Statistischer Modelle**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

27–31. **21st Holiday Mathematics Symposium on Gröbner Bases and Convex Polytopes**, New Mexico State University. (May/June 1994, p. 513)

1995

Second International Conference on Numerical Methods for Volterra and Delay Equations (A conference to celebrate the 100th anniversary of Volterra's birth.), Italy. (Mar. 1992, p. 251)

January 1995

January–June. **Financial Mathematics**, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK. (May/June 1994, p. 513)

4–7. **Joint Mathematics Meetings**, San Francisco, CA (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940; electronic mail: meet@math.ams.org.

*4–7. **Workshop for Women Graduate Students and Postdocs**, Joint Mathematics Meetings, San Francisco, CA.

SPONSORS: Association for Women in Mathematics, with funding from the National Science Foundation and the Office of Naval Research.

PROGRAM: Participants will have the opportunity to present and discuss their research and to meet with other women mathematicians at all stages of their careers. The workshop will also include a panel discussion, a luncheon, and a dinner banquet (honoring Judith D. Sally, the Emmy Noether Lecturer).

FUNDING: AWM will provide funding for up to ten women graduate students and ten women postdocs. To be eligible for funding, graduate students must have begun work on a thesis problem; postdocs must have received their Ph.Ds within approximately the last five years. Each application should include a curriculum vitae and a concise description of research; a graduate student applicant should include a letter of recommendation from her thesis advisor. All applications must be received by October 15, 1994. Send five copies of application materials to the address below.

APPLICATIONS AND INFORMATION: Workshop Selection Committee, Association for Women in Mathematics, 4114 Computer and Space Sciences Bldg., Univ. of Maryland, College Park, MD 20742-2461; tel: 301-405-7892; fax: 301-314-9363; e-mail: awm@math.umd.edu.

4–7. **Fifth International Workshop on Artificial Intelligence and Statistics**, Fort Lauderdale, Florida. (Sept. 1994, p. 844)

*4–14. **Applications of Dynamical Systems to Biology**, Technion–I.T.T., Haifa, Israel.

SPONSORS: The Institute for Advanced Studies in Mathematics and the Dept. of Math., the Technion–I.T.T.

PROGRAM: The workshop is intended to invoke interest in applications of dynamical systems to several subfields in mathematical biology (for example, neurobiology and ecological systems), and to stimulate new collaborations. A few guests will each give

a mini-course, focused on their fields. The mini-courses will be supplemented by additional seminar talks to be given by other speakers.

MINI-COURSE SPEAKERS: S. Levin (Princeton Univ.), J. Guckenheimer (Cornell Univ.), N. Kopell (Boston Univ.), B. Ermentrout (Univ. of Pittsburgh), K. P. Hadeler (Univ. of Tübingen), and S. Gueron and N. Liron (Technion-I.T.T.).

SEMINAR TALKS: A full list of speakers will be announced at a later date.

ORGANIZERS: N. Liron, G. Wolansky, and S. Gueron.

INFORMATION: S. Gueron, Dept. of Math., Technion-I.T.T., Haifa, 32000, Israel; voice/fax: +972 4 294092 (office); departmental fax: +972 4 324654; e-mail: shay@math.technion.ac.il.

6-7. **Association for Symbolic Logic, 1994-1995 Winter Meeting (in conjunction with the annual meeting of the AMS)**, San Francisco, California. (Sept. 1994, p. 844)

8-12. **8th Texas International Symposium on Approximation Theory**, College Station, TX. (May/June 1994, p. 514)

9-10. **Least Squares Methods: Theory, Algorithms and Applications**, Linköping, Sweden. (Sept. 1994, p. 844)

11-13. **Symposium to Celebrate Germund Dahlquist's 70th Birthday**, Stockholm, Sweden. (Sept. 1994, p. 844)

14-21. **The 15th Winter School: Geometry and Physics**, Smi. Bohemian Forest, Czech Republic. (Jul./Aug. 1994, p. 676)

15-17. **Random Partial Differential Equations**, MSI, Ithaca, NY. (May/June 1994, p. 514)

16-18. **1995 International Workshop on Numerical Solution of Markov Chains**, Raleigh, North Carolina. (Sept. 1994, p. 844)

16-19. **First Asian Computational Fluid Dynamics Conference**, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong. (Jan. 1994, p. 58)

17-20. **IMA Tutorial 1 on Inverse Problems in Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 146)

22-24. **Sixth ACM-SIAM Symposium on Discrete Algorithms**, San Francisco, CA. (Jul./Aug. 1994, p. 676)

22-25. **First International Symposium on High-Performance Computer Architecture**, Raleigh, N.C. (Jul./Aug. 1994, p. 676)

23-27. **3rd International Symposium on the Development of Mathematics**, Havana, Cuba. (May/June 1994, p. 514)

30-February 3. **IMA Tutorial 2 on Inverse Problems in Wave Propagation**, Inst. for Math. and its Applications, Univ. of Minnesota, Minneapolis, MN. (Feb. 1994, p. 146)

February 1995

3-5. **5th Annual Conference of Jammu Mathematical Society: A Symposium on Functional Analysis and Applications**, Department of Mathematics, Univ. of Jammu, India. (Sept. 1994, p. 845)

5-8. **The Joint Meeting of the Third Caribbean Congress on Fluid Dynamics and the Third Latin-American Symposium on Fluid Mechanics**, The University of Simon Bolívar, Caracas, Venezuela. (Apr. 1994, p. 384)

* 6-9. **Frontiers '95—The Fifth Symposium on the Frontiers of Massively Parallel Computation**, McLean Hilton, McLean, VA.

SPONSORS: IEEE/CS, NASA GSFC, UMIACS, and IEEE Technical Committee on Computer Architectures.

INVITED SPEAKERS: T. Blank (Maspar), P. Colella (UC Berkeley), K. Kennedy (Rice Univ.), and B. Smith (Tera Computer).

DEADLINES: The deadline for submission of papers and workshop or tutorial proposals was in July 18, 1994. The deadline for abstracts of poster sessions is November 1, 1994.

INFORMATION: electronic mail: frontiers95@umiacs.umd.edu.

8-11. **Third SIAM Conference on Mathematical and Computational Issues in the Geosciences**, San Antonio, TX. (Jul./Aug. 1994, p. 676)

15-17. **Seventh SIAM Conference on Parallel Processing for Scientific Computing**, San Francisco, CA. (Jul./Aug. 1994, p. 676)

19-25. **Applications of Interval Computations (First International Workshop)**, El Paso, TX. (May/June 1994, p. 514)

March 1995

4-5. **Eastern Section**, Hartford, Connecticut.

INFORMATION: W.S. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

6-17. **IMA Workshop on Inverse Problems in Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1994, p. 384)

17-18. **Southeastern Section**, Orlando, FL.

INFORMATION: W.S. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

* 17-18. **Workshop on Krylov Subspace Methods and Applications**, Raleigh, NC.

ORGANIZERS: I. Ipsen, e-mail: ipsen@math.ncsu.edu, and T. Kelley, e-mail: Tim_Kelley@ncsu.edu.

GOAL: The goal of the workshop is to broaden communication between the theoretical and applications camps by providing painless, and in fact stimulating opportunities, that help participants from both camps to learn about each others' problems and results.

PROGRAM: The workshop will consist of four half-day presentations on the interaction between theoretical, numerical, and application-specific aspects of a Krylov space method. Each presentation will be given by a two-person team consisting of a numerical analyst and a person working in an application area. The teams and topics of their presentations are: Y. Saad (Univ. of Minnesota), M. Heroux (Cray Research)—Fluid flow problems on unstructured meshes; D. Sorenson (Rice Univ.), H. van der Vorst (Utrecht Univ., The Netherlands)—Magnetohydrodynamics; N. Trefethen (Cornell Univ.), P. Schmid (Univ. of Washington)—Hydrodynamic stability; and L. Petzold (Univ. of Minnesota), P. van Keken (Univ. of Michigan)—Computational geodynamics and numerical relativity. INFORMATION: Send electronic mail to e-mail: krylov@math.ncsu.edu or finger krylov@math.ncsu.edu.

19-22. **Colloquium Carolus Magnus on Arithmetic and Geometry (Celebrating 1200 Years of Science in Central Europe)**, Aachen, Germany. (May/June 1994, p. 514)

20-21. **DIMACS Workshop on Global Minimization of Nonconvex Energy Functions: Molecular Conformation and Protein Folding**, DIMACS (Center for Discrete Mathematics and Theoretical Computer Science at Rutgers Univ.) (Jul./Aug. 1994, p. 676)

20-24. **3rd International Conference and Workshop on Approximations and Numerical Methods for the Solution of the Maxwell Equations**, Oxford, UK. (Sept. 1994, p. 845)

24-25. **Central Section**, DePaul University, Chicago, IL.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

26-29. **IMS Eastern Regional Meeting and Biometric Society/ENAR Spring Meeting**, Birmingham, AL. (May/June 1994, p. 514)

27-29. **The Applications of Logic**, York, UK. (Sept. 1994, p. 845)

27-April 1. **Dynamical Systems Conference**, Montevideo, Uruguay. (Sept. 1994, p. 845)

28-31. **Twenty-sixth Annual Iranian Mathematics Conference**, Shahid Bahonar Univ. of Kerman, Kerman, Iran. (Sept. 1994, p. 845)

29-31. **Environmental Modelling**, Lancaster Univ., UK. (Sept. 1994, p. 845)

30-April 2. **Association for Symbolic Logic**

Annual Meeting, University of California at Irvine. (Jul./Aug. 1994, p. 677)

April 1995

1–September 30. **Special Session and Conference on Geometry and Physics**, Matematisk Institut, Aarhus Universitet, Aarhus, Denmark (Sept. 1994, p. 845)

1–4. **International Conference on Survey Measurement and Process Quality**, Bristol, England. (May/June 1994, p. 514)

* 2–7. **Copper Mountain Conference on Multi-grid Methods**, Copper Mountain, CO.

ORGANIZING INSTITUTIONS: The Univ. of Colorado, Front Range Scientific Computations, Inc., and SIAM.

SPONSORS: Dept. of Energy and NASA.

FORMAT: There will be morning and late afternoon lectures of approximately twenty-five minutes each. Evenings will be reserved for the Circus (see below) and Workshops. Afternoons will be open for more informal workshops and discussions. CIRCUS AND WORKSHOPS: Anyone who wants to give a talk and will not be in the regular session may do so at one of the Circus sessions. Each session will begin by asking who wishes to speak and setting the Circus schedule accordingly. To provide a more informal atmosphere for discussion, there will also be time set aside for Workshops on specific topics of interest. The schedule for the Circus and Workshops will be determined each day according to demand.

STUDENT PAPER COMPETITION: Travel and lodging assistance will be awarded to students judged to have the best research papers. Papers with original research due mainly to the student must be received before December 1, 1994. They must be singly authored and no more than ten pages in length. Sending only an abstract is unacceptable. A panel of judges will determine the best papers. Authors of the three best papers will be given a travel stipend, free lodging, and will be expected to present their papers in a special session at the conference. Several other students who participate in the competition may be awarded free lodging, depending on the availability of funds. REGISTRATION for all students is free of charge.

CALL FOR PAPERS: Potential contributors should submit an abstract of no more than 200 words by hard copy regular mail or, preferably, by PostScript or ASCII e-mail to CCMM95, Univ. of Colorado, Program in Applied Math, CB 526, Boulder, CO 80309-0526, or e-mail: ccmm@boulder.colorado.edu. If submitted by e-mail, TEX or LATEX files will not be accepted. Send only PostScript or ASCII files. Dead-

line for submission of abstracts is January 1, 1995.

INFORMATION: Logistics and registration information: e-mail: ccmm@boulder.colorado.edu or contact S. McCormick, Univ. of Colorado, Program in Applied Math, CB 526, Boulder, CO 80309-0526; phone: 303-492-0662. The schedule of talks may be obtained in Feb. by accessing: e-mail: ccmminfo@boulder.colorado.edu.

2–9. **7th International Conference on Geometry**, Nahsholim, Israel. (May/June 1994, p. 514)

4–6. **IMA Tutorial on Singularities and Oscillations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

5–7. **International Conference on Rewriting Techniques and Applications (RTA-95)**, Kaiserslautern, Germany. (Jul./Aug. 1994, p. 677)

6–8. **Geometric Mechanics, Dynamical Systems and Control Theory**, Fayetteville, Arkansas (Sept. 1994, p. 845)

* 7–8. **Second Mississippi State Conference on Differential Equations & Computational Simulations**, Mississippi State Univ.

ORGANIZERS: R. Shivaji (Dept. of Math. and Statistics) and B. Soni (NSF Engineering Research Ctr.).

INVITED SPEAKERS: K. J. Brown (Heriot-Watt Univ., Scotland), L. Caffarelli (Inst. of Advanced Study), D. Caughey (Cornell Univ.), J. Eisenfeld (Univ. of Texas-Arlington), J. Hale (Georgia Tech.), P. D. Lax (NYU-Courant), R. McCormack (Stanford Univ.), J. Mallet-Paret (Brown Univ.), and H. Yee (NASA Ames Research Ctr.).

PROGRAM AND INFORMATION: This interdisciplinary conference will provide a joint forum where mathematicians, scientists, and engineers from academia and industry can exchange research ideas involving theoretical and applied developments in differential equations and computational simulations. In addition to the nine principal lectures, there will be sessions of contributed talks. This conference is held biannually. Abstracts for contributed papers should be submitted no later than January 20, 1995, to the following address, from which further information may also be obtained: R. Shivaji, P.O. Drawer MA, Mississippi State, MS 39762; phone: 601-325-3414; fax: 601-325-0005; e-mail: shivaji@math.msstate.edu.

10–12. **International Conference on Typed Lambda Calculi and Applications (TLCA)**, Edinburgh, Scotland. (May/June 1994, p. 514)

10–12. **The Application of Statistical Methods to Quality Improvement**, Cirencester, UK. (Sept. 1994, p. 846)

10–14. **IMA Workshop on Singularities and Oscillations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

Spring 1995. **Workshop on Groups and Three-Manifolds**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 59)

Spring-Summer 1995. **Workshop on Gauge Theory and Applications to Low-dimensional Topology**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 59)

Spring-Summer 1995. **Workshop on Symplectic Geometry and Topology**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 59)

23–25. **Conference on Applied Statistics in Agriculture**, Manhattan, KS. (May/June 1994, p. 515)

23–26. **KdV '95**, Amsterdam, The Netherlands. (Dec. 1993, p. 1453)

* 23–29. **Mathematics Awareness Week 1995 ("Mathematics and Symmetry")**

SPONSOR: Joint Policy Board for Mathematics.

THEME: Every year, Mathematics Awareness Week celebrates the richness and relevance of mathematics and provides an excellent opportunity to convey this message through local events. During a week-long celebration from Sunday, April 23 to Saturday, April 29, 1995, the festivities will highlight Mathematics and Symmetry. Mark your calendars now and plan to observe Mathematics Awareness Week in your area, school, or organization.

24–28. **Third International Conference on Mathematical and Numerical Aspects of Wave Propagation**, Juan-les-Pins, France. (Jul./Aug. 1994, p. 677)

25–28. **9th International Parallel Processing Symposium**, Fess Parker's Red Lion Resort, Santa Barbara, California. (Sept. 1994, p. 846)

27–29. **Third SIAM Conference on Control and Its Applications**, St. Louis, MO. (Jul./Aug. 1994, p. 677)

May 1995

* 8–15. **Workshop on Planar Harmonic Mappings**, Dept. of Math., Technion, Haifa, Israel.

INVITED SPEAKERS: P. Duren (Univ. of Michigan), W. Hengartner (Université Laval), and T. Sheil-Small (York Univ.).

CALL FOR PAPERS: Contributed papers are welcome.

INFORMATION: D. Aharonov and D. Bshouty,

e-mail: mar19aa@technion.technion.ac.il.

11–13. **First International Conference on Nonlinear Problems in Aviation and Aerospace 1995**, Embry-Riddle Aeronautical University, Daytona Beach, FL. (Sep. 1993, p. 928)

14–20. **Mathematical Models in Phase Transitions**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

16–18. **European Convention on Security and Detection**, Brighton, UK. (Sept. 1994, p. 846)

16–18. **IMA Tutorial on Quasiclassical Methods**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

16–20. **International Conference on Analytic Number Theory**, University of Illinois, Allerton Park, Monticello, IL. (Sept. 1994, p. 846)

16–20. **Seventh International Conference on Random Structures and Algorithms**, Emory University, Atlanta, GA. (May/June 1994, p. 515)

21–24. **Third SIAM Conference on Dynamical Systems**, Snowbird, UT. (Jul./Aug. 1994, p. 677)

22–26. **IMA Workshop on Quasiclassical Methods**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

24–27. **Second International Conference on Dynamic Systems and Applications**, Atlanta, GA. (May/June 1994, p. 515)

25–June 5. **Summer School and International Conference on Combinatorics**, Hefei, China. (May/June 1994, p. 515)

28–31. **First International Conference on Neural, Parallel & Scientific Computations**, Atlanta, GA. (May/June 1994, p. 515)

29–June 1. **International Conference on Mathematical Modelling**, Universiti Brunei Darussalam, Brunei Darussalam. (Feb. 1994, p. 146)

29–June 2. **Seventh International Conference on Formal Power Series and Algebraic Combinatorics**, Marne-la-Vallée, Paris, France. (Jul./Aug. 1994, p. 678)

31–June 3. **Tenth Biennial Conference of the Association of Christians in the Mathematical Sciences**, Taylor Univ., Upland, IN. (Jul./Aug. 1994, p. 678)

June 1995

Model Oriented Data Analysis, Spetses, Greece. (May/June 1994, p. 515)

5–7. **3rd International Applied Statistics in Industry Conference (Continuing Continuous Improvement)**, Dallas, Texas (Sept. 1994, p. 846)

5–8. **International Conference on Optimization: Techniques and Applications (ICOTA '95)**, Chengdu University of Science and Technology, Chengdu, China. (May/June 1994, p. 515)

6–10. **Symposium on Inertial Manifolds, Approximate Inertial Manifolds, and Related Numerical Algorithms**, Xi'an, China. (Jul./Aug. 1994, p. 678)

7–8. **IMA Tutorial on Multiparticle Quantum Scattering with Applications to Nuclear, Atomic, and Molecular Physics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1994, p. 385)

12–16. **Brazil-USA Conference on Multidimensional Complex Analysis and Partial Differential Equations**, São Carlos, SP, Brazil. (Sept. 1994, p. 847)

12–16. **IMA Workshop on Multiparticle Quantum Scattering with Applications to Nuclear, Atomic, and Molecular Physics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1994, p. 385)

* 17–20. **Second IMACS International Symposium on Iterative Methods in Linear Algebra**, Blagoevgrad, Bulgaria.

ORGANIZERS: The International Association for Mathematics and Computers in Simulation and Bulgarian Academy of Sciences (BAS).

TOPICS: Matrix analysis (convergence acceleration; preconditioning techniques; methods for nonsymmetric, indefinite, singular and overdetermined systems; sparse eigenproblems); applications to PDEs (multigrid methods, domain decomposition methods, spectral methods), systems theory, least square problems, parallel matrix computation; and software development (sparse linear systems, sparse eigenproblems, application oriented software, on sequential machines, on parallel machines).
CALL FOR PAPERS: Deadline for submission of abstracts (one page stating clearly the originality and importance of the results): October 1994. Deadline for submission of full papers: March 1995.

INFORMATION: P. S. Vassilevski, Second IMACS Int. Symp. on Iterative Methods in Linear Algebra, CICT at Bulgarian Acad. of Sciences, "Acad. G. Bontchev" Street, block 25A, 1113 Sofia, Bulgaria; e-mail: panayot@bgearn.bitnet or imacs95@bgearn.bitnet.

* 19–22. **Structure in Complexity Theory, Tenth Annual IEEE Conference**, Minneapolis, Minnesota.

PROGRAM COMMITTEE: E. Allender (chair), K. Ambos-Spies, L. Fortnow, R. Impagliazzo, K.I. Ko, J. Köbler, R. Lipton, and K. Regan.

CONFERENCE TOPICS: All areas of computational complexity theory, including: structure of complexity classes, properties of complete sets, resource-bounded reducibilities, relativizations, circuit complexity, complexity and logic, interactive proof systems, computational randomness, Kolmogorov complexity, cryptographic complexity, circuits and other concrete computational models, and complexity and learning.

CALL FOR PAPERS: Send eight copies of an extended abstract to the program chair, E. Allender, Dept. of Computer Science, Rutgers Univ., New Brunswick, NJ 08903. The deadline for abstracts is December 1, 1994.

INFORMATION: J. Royer, Dept. of Computer and Inf. Sci., Syracuse Univ., Syracuse, NY 13244; e-mail: structures@top.cis.syr.edu.

* 19–25. **II International Conference on Homotopy Theory**, Palazzo Feltrinelli (Univ. of Milano), Gargnano, Garda Lake, Italy.

SCIENTIFIC COMMITTEE: A. Dold (Heidelberg), I. M. James (Oxford), R. A. Piccinini (Milano), and D. Ravenel (Rochester).

INFORMATION: R. Piccinini, Univ. of Milan; fax: 39-2-7063 0346; e-mail: renzo@vniimat.mat.unimi.it.

19–30. **NATO Advanced Study Institute on "Hamiltonian Systems with Three or More Degrees of Freedom"**, S'Agaró, Barcelona, Spain. (Sept. 1994, p. 847)

* 20–23. **International Conference on Ordinal and Symbolic Data Analysis**, Paris, France.

OBJECTIVES: This conference is in the tradition of conferences held previously in Antibes (1990), and Paris (1992) on numeric and symbolic analysis, and in Darmstadt (1992) and Amherst (1993) on ordinal data analysis. The ordinal and symbolic approaches to data analysis have been successfully developed during those years via stimulating workshops and conferences for experts in the field. Both approaches have particularly emphasized the intentional background of data which is necessary for validation, interpretation, and communication. Since many observed or experimental data sets (including sequential, textual, spatial, relational...) are of symbolic or ordinal nature, it has become increasingly clear that ordinal and symbolic data analysis has applications in a large number of areas including medicine, biology, social sciences, economics, agronomy, data retrieval, information sciences, etc.

CALL FOR PAPERS: A two-page abstract involving one or more of the following topics is requested: methods for sequen-

tial, spatial, textual and more generally numeric-symbolic, structural and ordinal data; measurement theory; proximities, distances, and ultrametrics; geometrical representation; concept analysis; aggregation and fusion; ordinal structures (graph models, lattices, hierarchies, pyramids, etc.); consensus; feature reduction and extraction; knowledge and rule discovery from data; philosophical foundation of class, categories, concepts, semiotic and cognitive aspects; and computer software. The deadline for submission of abstracts is November 30, 1994.

INFORMATION: INRIA Rocquencourt - Conference Secretariat: Claudie Thenault/ Relations Exterieures, Domaine de Voluceau, BP 105-78153 Le Chesnay Cedex, France; tel: 33 (1) 39 63 56 75; fax: 33 (1) 39 63 56 38; e-mail: symposia@inria.fr.

20–24. **AMCA-95 International Conference on Advanced Mathematics, Computations and Applications**, Academtown, Novosibirsk, Russia. (Sept. 1994, p. 847)

*22–24. **Achieving Gender Equity in the Classroom and on the Campus—The Next Steps**, Disney's Contemporary Resort; Lake Buena Vista, Florida.

CALL FOR PAPERS: The American Association of University Women (AAUW) is seeking proposals for its symposium (single papers, complete sessions, or panels). Topics will address: advancing the status of women as employees in public or higher education, achieving equity for women and girls as students, and fostering a positive school/campus climate.

INFORMATION: American Association of University Women, 1111 Sixteenth St. N.W., #5188, Washington, D.C. 20036-4873; tel: 202-785-7759.

27–29. **Moving Boundaries 95 (Computational Modelling of Free and Moving Boundary Problems)**, Bled, Slovenia. (Sept. 1994, p. 847)

28–30. **Conference on the Legacy of George Boole**, University College, Cork, Ireland. (Sept. 1994, p. 847)

July 1995

3–7. **AMAST'95, Fourth International Conference on Algebraic Methodology and Software Technology**, Concordia University, Montreal, Canada. (Jul./Aug. 1994, p. 678)

3–7. **The Third International Congress on Industrial and Applied Mathematics**, CCH Congress Centrum, Hamburg, Germany. (Jan. 1994, p. 59)

8–9. **Mathematica in Mathematics Research and Education**, University of Tasmania. (May/June 1994, p. 516)

10–12. **Conference on Linear Algebra and its Applications**, University of Manchester, England. (Jan. 1994, p. 59)

10–14. **7th Biennial Conference of the Computational Mathematics Group at Melbourne (CTAC 95)**, Melbourne, Australia. (May/June 1994, p. 516)

17–19. **BEM 17–17th International Conference on Boundary Element Methods**, Madison, Wisconsin. (Sept. 1994, p. 847)

*17–21. **Modelling and Optimization of Distributed Parameter Systems with Applications to Engineering**, Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland.

THEME: The aim of the conference is to present the newest results and exchange ideas between people working on theoretical and numerical aspects of modelling and optimization of distributed parameter systems and those interested in engineering applications (with emphasis on mechanical engineering and environmental problems). TOPICS: PDEs and variational inequalities with applications, inverse problems in PDEs, approximation and regularization methods, numerical methods and algorithms, control and optimization, sensitivity and stability analysis, shape optimization, and modelling of behavior of nonlinear materials (e.g., hysteresis, memory and shape memory effects) in DPS.

CALL FOR PAPERS: Authors wishing to present papers are requested to send a copy of an enlarged abstract (1–2 pages in English) to the secretary prior to February 28, 1995, for reviewing by the International Program Committee.

INFORMATION: M. Peszynska, IFIP Conference, Systems Research Institute, Polish Academy of Sciences, Nowelska 6, PL-01-447 Warsaw, Poland; tel: (+4822) 364414, 370521; fax: (+4822) 372772; e-mail: ifip@ibspan.waw.pl.

17–21. **International Conference on the Mathematics of Program Construction**, Kloster Irsee, Germany. (Jul./Aug. 1994, p. 679)

*31–August 2. **Rocky Mountain Numerical Analysis and Applications Conference**, Salt Lake City, Utah.

PROGRAM: The object is to have an informal meeting of interested people to give talks, discuss problems, share ideas, and have a good and productive time with colleagues. The presentations should be of about thirty minutes in length, with the possibility of some longer talks. There will also be two special workshops, one on Sinc functions and the other on simulation of flow in porous media. Funds may be obtained for local housing. Those interested in participating should send a short abstract, including e-mail address, to one of

the co-organizers below.

INFORMATION: B. Chen, Math Dept., P. O. Box 3036, Laramie, WY 82071; tel: 307-766-2280; e-mail: bchen@uwyo.edu; or F. Stenger, Computer Science Dept., 4017 Engineering, Salt Lake City, UT 84112; tel: 801-585-SINC; e-mail: stenger@sinc.cs.utah.edu.

August 1995

1–5. **16th Rolf Nevanlinna Colloquium**, University of Joensuu, Joensuu, Finland. (Sept. 1994, p. 847)

6–8. **MATHFEST**, University of Vermont, Burlington, Vermont (including the summer meetings of the AMS, AWM, MAA, and PME).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

7–12. **Fourth Quadrennial International Conference on Abelian Groups and Modules**, Colorado Springs, CO. (Jul./Aug. 1994, p. 679)

10–17. **Logic Colloquium 1995**, Israel (Haifa or Jerusalem). (Jul./Aug. 1994, p. 679)

13–17. **Fourth International Colloquium on Numerical Analysis**, Plovdiv, Bulgaria. (Sept. 1994, p. 848)

13–17. **Second International Colloquium on Oscillation Theory**, Plovdiv, Bulgaria. (Sept. 1994, p. 848)

18–23. **Sixth International Colloquium on Differential Equations**, Plovdiv, Bulgaria. (Sept. 1994, p. 848)

*28–September 1. **Fourth International Conference on Function Spaces**, Institute of Mathematics, Tadeusz Kotarbiński Pedagogical Univ., Zielona Góra, Poland.

ORGANIZING COMMITTEE: J. Musielak, H. Hudzik, and M. Nowak.

INFORMATION: M. Nowak, Institute of Mathematics, Tadeusz Kotarbiński Pedagogical Univ., Plac Slowiański 9, 65-069 Zielona Góra, Poland.

28–September 1. **A.C. Aiken Centenary Conference, incorporating the 3rd Pacific Statistical Congress and the annual meeting of the New Zealand Statistical Association**, University of Otago. (May/June 1994, p. 516)

September 1995

3–9. **Function Spaces, Differential Operators, and Nonlinear Analysis**, Paesky, Krkonoše, Czech Republic. (Jul./Aug. 1994, p. 679)

13–15. **BETECH 10-Tenth International Conference on Boundary Element Technology**, Liege, Belgium. (Sept. 1994, p. 848)

Meetings and Conferences

*18–23. **Twenty-fifth National Conference on Geometry and Topology CNGT 25**, University "A.I. Cuza" Iasi, România.

INFORMATION: V. Cruceanu, University "A.I. Cuza" Iasi, Department of Geometry, B-dul Copou 11, R-6600, Iasi, România; fax: 40-32-146330; e-mail: UAIC@ROEARN.ICI.RO.

17–21. **Symposium on Acoustics of Submerged Structures & Transduction Systems**, Boston, MA. (Jul./Aug. 1994, p. 679)

19–21. **OPTI 95—Fourth International Conference on Computer Aided Optimum Design of Structures**, Miami, Florida. (Sept. 1994, p. 848)

October 1995

7–8. **Eastern Section**, Northeastern University, Boston, Massachusetts.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

*17–20. **The Second Asian Mathematics Conference (AMC '95)**, Nakhon Ratchasima, Thailand.

PROGRAM: The conference will feature eight plenary speakers and about forty invited speakers from mainly Asian countries. There will also be short sessions (fifteen minutes) for contributed papers. Submission deadline is March 15, 1995 (one-page abstract or paper).

CONFERENCE TOPICS: All areas of mathematics will be represented, classified as follows: analysis, algebra and number theory, geometry and topology, combinatorics and graphs, applied mathematics and numerical analysis, probability and statistics, and teaching and popularization of mathematics.

INFORMATION: A. P. Chayasena, School of Mathematics, Suranaree Univ. of Technology, Nakhon Ratchasima 30000, Thailand; tel: (INTL)-66-44-216-101; fax: (INTL)-66-44-216-106; e-mail: amc95@sural.sut.ac.th.

The following new announcements will not be repeated until the criteria in the last paragraph in the box at the beginning of this section are met.

November 1995

3–4. **Central Section**, Kent State University, Kent, Ohio.

INFORMATION: W. Drady, AMS, P.O. Box

6887, Providence, RI 02940; e-mail: meet@math.ams.org.

17–18. **Southeastern Section**, University of North Carolina, Greensboro, NC.

INFORMATION: W.S. Drady, AMS P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

December 1995

*18–21. **1st Asian Technology Conference in Mathematics (ATCM)**, Singapore.

CONFERENCE THEME: The theme is the innovative use of technology for teaching and research in mathematics. There is always a quest for improvement in teaching mathematics at various levels, ranging from the primary to the tertiary. Enthusiasts have looked into new approaches of teaching and conducting research. Technology is one area which has great potential as technological knowledge seems to advance at a greater pace than expected. The First Asian Conference in Mathematics will provide mathematics educators, computer specialists, technologists, researchers, policymakers, and teachers with the opportunity to share and discuss the latest developments in their areas of specialization. The Conference also provides an avenue for the possibility of collaborating research among the participants. Papers are invited for presentation at the Conference from those who are involved in the use of technology in teaching and research in higher institutions and schools.

CONFERENCE PROGRAM: The Conference will feature three main categories: plenary speeches, paper presentations, and workshops in teaching mathematics and research with the use of technologies. Eminent speakers will be invited to deliver plenary speeches. Paper presentations will be organized to cater to the primary, secondary, and tertiary levels. Special groups will also be organized to discuss topics such as development of educational software and research for improvement in teaching and learning of mathematics. Exhibition of educational products with the use of technology is included in the Conference.

CALL FOR PAPERS: Abstracts of not more than 200 words should be mailed to: F. H. Kheong, chair, ATCM 95 Organizing Committee, c/o Nanyang Technological Univ., National Institute of Education, 469 Bukit Timah Road, Singapore 1025; tel: (65) 460 5310; fax: (65) 469 8952; e-mail: fonghk@nievax.nie.ac.sg.; or W.-C. Yang, chair, IPC, ATCM 95, Department of Math/Stat, Radford University, Radford, VA 24142; tel: 703-831-5232 or 703-831-

5670; fax: 703-831-6452; e-mail: wyang@mathstat.ms.runet.edu. The deadline for abstracts is November 30, 1994. The deadline for submission of full papers is March 31, 1995.

REGISTRATION FEE: The registration fee is \$200 (U.S. \$135).

LANGUAGE: All presentations, workshops, and discussion in special groups will be conducted in English.

January 1996

10–13. **Joint Mathematics Meetings**, Orlando, Florida (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

March 1996

22–23. **Central Section**, University of Iowa, Iowa City, Iowa.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

April 1996

19–21. **Southeastern Section**, Baton Rouge, Louisiana.

INFORMATION: W.S. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

November 1996

1–3. **Central Section**, University of Missouri at Columbia, Columbia, Missouri.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

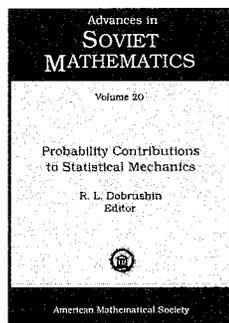
January 1997

10–13. **Joint Mathematics Meetings**, San Diego, California (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940; e-mail: meet@math.ams.org.

New Publications Offered by the AMS

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Probability Contributions to Statistical Mechanics

R. L. Dobrushin, Editor
Volume 20

Physics has always been a fertile source of new mathematical notions and ideas, and in the past decade the stream of ideas from physics to mathematics has increased dramatically. The subfield of statistical mechanics is no exception. Containing papers written by representatives of the

Moscow school of mathematical statistical mechanics, this volume illustrates certain aspects of the developing interaction between statistical mechanics on the one hand and the theories of probability and of dynamical systems on the other. Included here are papers on random walks, phase transition phenomena for Gibbs random fields, the existence of nonstandard motion integrals in statistical physics models, and the Frenkel-Kontorova model.

Contents

J. Abdullaev and R. A. Minlos, *An extension of the Ising model*; **C. Boldrighini, R. A. Minlos, and A. Pellegrinotti**, *Central limit theorem for the random walk of one and two particles in a random environment, with mutual interaction*; **R. A. Minlos**, *Random walk of a particle interacting with a random field*; **R. L. Dobrushin and S. B. Shlosman**, *Large and moderate deviations in the Ising model*; **B. M. Gurevich**, *Asymptotically additive integrals of motion for particles with nonpairwise interaction in dimension one*; **L. D. Pustyl'nikov**, *On a ground state in the Frenkel-Kontorova model and metric properties of mappings of standard type*.

1991 Mathematics Subject Classification: 82Bxx

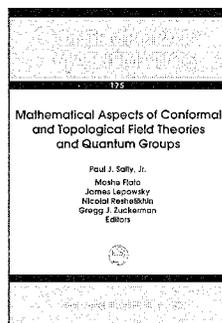
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Mathematical Aspects of Conformal and Topological Field Theories and Quantum Groups

Paul J. Sally, Jr., Moshe Flato, James Lepowsky, Nicolai Reshetikhin, and Gregg J. Zuckerman, Editors
Volume 175

This book contains papers presented by speakers at the AMS-IMS-SIAM Joint Summer Research Conference on Conformal Field Theory, Topological Field Theory and Quantum Groups, held at Mount Holyoke College in June 1992. One group of papers deals with one aspect of conformal field theory, namely, vertex operator algebras or superalgebras and their representations. Another group deals with various aspects of quantum groups. Other topics covered include the theory of knots in three-manifolds, symplectic geometry, and tensor products. This book provides an excellent view of some of the latest developments in this growing field of research.

Contents

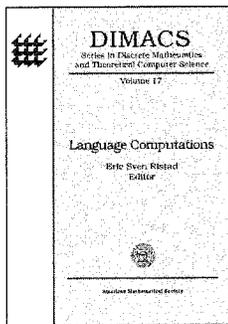
K. Aomoto and Y. Kato, *Connection coefficients for A-type Jackson integral and Yang-Baxter equation*; **C. Dong**, *Representations of the moonshine module vertex operator algebra*; **C. Dong and G. Mason**, *The construction of the moonshine module as a Z_p -orbifold*; **M. Flato and D. Sternheimer**, *Star products, quantum groups, cyclic cohomology, and pseudodifferential calculus*; **C. Fronsdal and A. Galindo**, *The universal T-matrix*; **G. Georgiev and O. Mathieu**, *Fusion rings for modular representations of Chevalley groups*; **V. Ginzburg, N. Reshetikhin, and E. Vasserot**, *Quantum groups and flag varieties*; **Y.-Z. Huang and J. Lepowsky**, *Operadic formulation of the notion of vertex operator algebra*; **L. C. Jeffrey and J. Weitsman**, *Torus actions, moment maps, and the symplectic geometry of the moduli space of flat connections on a two-manifold*; **V. Kac and W. Wang**, *Vertex operator superalgebras and their representations*; **T. Kohno**, *Topological invariants for 3-manifolds using representations of mapping class groups II: Estimating tunnel number of knots*; **M. A. Semenov-Tian-Shansky**, *Poisson Lie groups, quantum duality principle, and the quantum double*; **Y. S. Stanev and I. T. Todorov**, *Local 4-point functions and the Knizhnik-Zamolodchikov equation*.

(continued)

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Language Computations
 Eric Sven Ristad, Editor
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This book contains the refereed proceedings of the DIMACS Workshop on Human Language, held in March 1992 at Princeton University. The workshop drew together many of the world's most prominent linguists, computer scientists, and learning theorists to focus on language computations. A language computation is a computation that underlies the

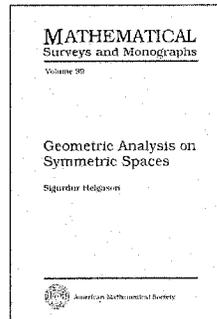
comprehension, production, or acquisition of human language. These computations lie at the very heart of human language. This volume aims to advance understanding of language computation, with a focus on computations related to the sounds and words of a language. The book investigates sensory-motor representation of speech sounds (phonetics), phonological stress, problems in language acquisition, and the relation between the sound and the meaning of words (morphology). The articles are directed toward researchers with an interest in human language and in computation. Although no article requires expertise in linguistics or computer science, some background in these areas is helpful, and the book provides relevant references.

Contents

Part I. Phonetics: O. Fujimura, *C/D model: A computational model of phonetic implementation*; A. Kornai, *Relating phonetic and phonological categories*; **Part II. Metrical Phonology:** M. Halle and W. Idsardi, *General properties of stress and metrical structure*; B. E. Dresher, *Acquiring stress systems*; L. Burzio, *Metrical consistency*; **Part III. Learning Frameworks:** M. Li and P. Vitányi, *Inductive reasoning*; J. Rissanen and E. S. Ristad, *Language acquisition in the MDL framework*; **Part IV. Morphology:** S. R. Anderson, *Parsing morphology: "Factoring" words*; E. S. Ristad, *Complexity of morpheme acquisition*.

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**MATHEMATICAL SURVEYS AND
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**Geometric Analysis
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This book gives the first systematic exposition of geometric analysis on Riemannian symmetric spaces and its relationship to the representation theory of semisimple Lie groups. The book starts with modern integral geometry for double fibrations and treats several examples in

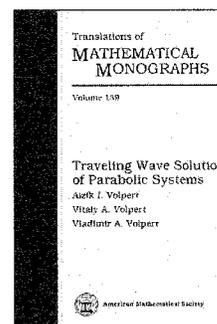
detail. After discussing the theory of Radon transforms and Fourier transforms on symmetric spaces, Helgason examines applications to invariant differential equations on symmetric spaces, particularly potential theory and wave equations. The book concludes with a chapter on eigenspace representations—that is, representations on solution spaces of invariant differential equations. Known for his high-quality expositions, Helgason received the 1988 AMS Steele Prize for his earlier books "Differential Geometry, Lie Groups and Symmetric Spaces" and "Groups and Geometric Analysis". Containing exercises (with solutions) and references to further results, this new book would be suitable for advanced graduate courses in modern integral geometry, analysis on Lie groups, or representation theory of semisimple Lie groups.

Contents

A duality in integral geometry; A duality for symmetric spaces; The Fourier transform on a symmetric space; The Radon transform on X and on X_0 . Range questions; Differential equations on symmetric spaces; Eigenspace representations; Solutions to exercises; Bibliography.

1991 *Mathematics Subject Classification*: 43A85, 53C35, 22E46, 22E30, 43A90, 44A12, 32M15; 53C65, 58G35, 31A20, 43A35, 35L05
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 Volume 139

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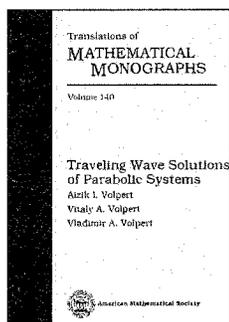
of arbitrary order. In addition to monotone operator methods, a broad

range of applications of topological methods to nonlinear differential equations is presented: solvability, estimation of the number of solutions, and the branching of solutions of nonlinear equations. Skrypnik establishes, by various procedures, a priori estimates and the regularity of solutions of nonlinear elliptic equations of arbitrary order. Also covered are methods of homogenization of nonlinear elliptic problems in perforated domains. The book is suitable for use in graduate courses in differential equations and nonlinear functional analysis.

Contents

Mappings of monotone type and solvability of quasilinear boundary value problems; Degree of generalized monotone mappings; Topological characteristics of nonlinear elliptic boundary value problems; Solvability and behavior of solutions of nonlinear elliptic boundary value problems; Solvability of the nonlinear Dirichlet problem in a narrow strip; Solvability of semilinear boundary value problems; A priori estimates and regularity of solutions of higher order quasilinear elliptic equations; Behavior of solutions of quasilinear elliptic equations near the boundary; Nonlinear elliptic problems in domains with fine-grained boundary; Homogenization of nonlinear Dirichlet problems in domains with channels; References.

1991 *Mathematics Subject Classification*: 35J65; 35G30, 35J40
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Traveling Wave Solutions of Parabolic Systems

Aizik I. Volpert, Vitaly A. Volpert, and Vladimir A. Volpert
 Volume 140

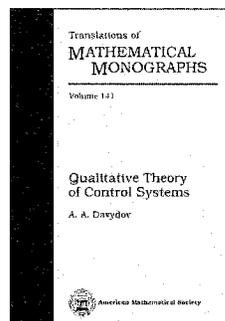
The theory of traveling waves described by parabolic equations and systems is a rapidly developing branch of modern mathematics. This book presents a general picture of current results about

wave solutions of parabolic systems, their existence, stability, and bifurcations. The main part of the book contains original approaches developed by the authors. Among these are a description of the long-term behavior of the solutions by systems of waves; construction of rotations of vector fields for noncompact operators describing wave solutions; a proof of the existence of waves by the Leray-Schauder method; local, global, and nonlinear stability analyses for some classes of systems; and a determination of the wave velocity by the minimax method and the method of successive approximations. The authors show that wide classes of reaction-diffusion systems can be reduced to so-called monotone and locally monotone systems. This fundamental result allows them to apply the theory to combustion and chemical kinetics. With introductory material accessible to nonmathematicians and a nearly complete bibliography of about 500 references, this book is an excellent resource on the subject.

Contents

Part I. Stationary waves: *Scalar equation; Leray-Schauder degree; Existence of waves; Structure of the spectrum; Stability and approach to a wave;*
Part II. Bifurcation of waves: *Bifurcation of nonstationary modes of wave propagation; Mathematical proofs;* **Part III. Waves in chemical kinetics and combustion:** *Waves in chemical kinetics; Combustion waves with complex kinetics; Estimates and asymptotics of the speed of combustion waves; Asymptotic and approximate analytical methods in combustion problems (supplement); Bibliography.*

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 ISBN (Set) 0-8218-4609-4 LC 94-16518, ISSN 0065-9282
 448 pages (hardcover), October 1994
Individual member \$85. List price \$142, Institutional member \$114
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Qualitative Theory of Control Systems

A. A. Davydov
 Volume 141

This book analyzes control systems using results from singularity theory and the qualitative theory of ordinary differential equations. The main part of the book focuses on systems with two-dimensional phase space. The study of singularities of controllability boundaries

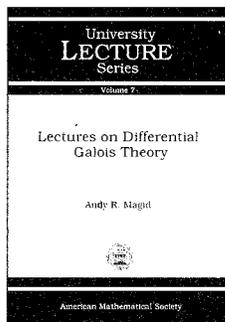
for a typical system leads to the classification of normal forms of implicit first-order differential equations near a singular point. Davydov indicates several applications of these normal forms. The book is accessible to graduate students and researchers working in control theory, singularity theory, and various areas of differential equations, as well as in applications.

Contents

Implicit first-order differential equations; Local controllability of a system; Structural stability of control systems; Attainability boundary of a multidimensional system; References.

1991 *Mathematics Subject Classification*: 34C20, 93C15, 94D20; 34A34, 49J17
 ISBN (Set) 0-8218-4590-X LC 94-30834, ISSN 0065-9282
 147 pages (hardcover), October 1994
Individual member \$45. List price \$75, Institutional member \$60
 To order, please specify MMONO/141N

UNIVERSITY LECTURE SERIES



Lectures on Differential Galois Theory

Andy R. Magid
 Volume 7

Differential Galois theory studies solutions of differential equations over a differential base field. In much the same way that ordinary Galois theory is the theory of field extensions generated by solutions of (one variable) polynomial equations, differential Galois theory looks

at the nature of the differential field extension generated by the solutions of differential equations. An additional feature is that the corresponding differential Galois groups (of automorphisms of the extension fixing the base and commuting with the derivation) are algebraic groups. This book deals with the differential Galois theory of linear homogeneous differential equations, whose differential Galois groups are algebraic matrix groups. In addition to providing a convenient path to Galois theory, this approach also leads to the constructive solution of the inverse problem of differential Galois theory for various classes of algebraic groups. Providing a self-contained development and many explicit examples, this book provides a unique approach to differential

Galois theory and is suitable as a textbook at the advanced graduate level.

Contents

Differential ideals; The Wronskian; Picard-Vessiot extensions; Automorphisms of Picard-Vessiot extensions; The structure of Picard-Vessiot extensions; The Galois correspondence and its consequences; The inverse Galois problem.

1991 *Mathematics Subject Classification:* 12H05
 ISBN (Set) 0-8218-7004-1 LC 94-10431, ISSN 1047-3998
 105 pages (softcover), October 1994
Individual member \$21, List price \$35, Institutional member \$28
 To order, please specify ULECT/7N

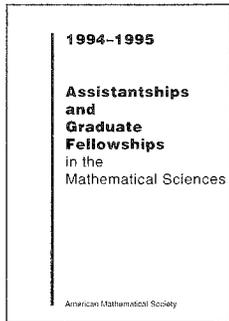
AMS PUBLICATIONS NOT IN SERIES

number (if available), and electronic address (if indicated), and also indicates membership in the three participating societies. The second is a list of individual members according to their geographic locations. In addition, the *CML* lists academic, institutional, and corporate members of the three participating societies providing addresses and telephone numbers of mathematical sciences departments.

The *CML* is distributed on request to AMS members in even-numbered years. MAA members can request the *CML* in odd-numbered years from the MAA. The *CML* is an invaluable reference for keeping in touch with colleagues and for making connections in the mathematical sciences community in the United States and abroad.

1991 *Mathematics Subject Classification:* 00
 ISBN (Set) 0-8218-0184-8
 376 pages (softcover), October 1994
Individual member \$34, List price \$56, Institutional member \$45
 To order, please specify CML/94/95N

SOCIÉTÉ MATHÉMATIQUE DE FRANCE, ASTÉRISQUE



Assistantships and Graduate Fellowships in the Mathematical Sciences, 1994-1995

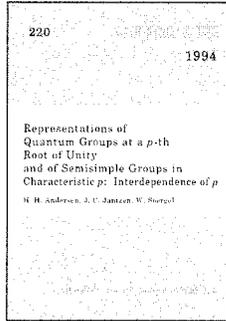
This publication is an indispensable source of information for students seeking support for graduate study in the mathematical sciences. Providing data from a broad range of academic institutions, it is also a valuable resource for mathematical sciences departments

and faculty.

Assistantships and Graduate Fellowships brings together a wealth of information about resources available for graduate study in mathematical sciences departments in the U.S. and Canada. Information on the number of faculty, graduate students, and degrees awarded (bachelor's, master's, and doctoral) is listed for each department when provided. Stipend amounts and the number of awards available are given, as well as information about foreign language requirements. Numerous display advertisements from mathematical sciences departments throughout the country provide additional information.

Also listed are sources of support for graduate study and travel, summer internships, and graduate study in the U.S. for foreign nationals. Finally, a list of reference publications for fellowship information makes *Assistantships and Graduate Fellowships* a centralized and comprehensive resource.

1991 *Mathematics Subject Classification:* 00
 ISBN (Set) 0-8218-0187-2 ISSN 1040-7650
 125 pages (softcover), September 1994
Individual member \$10, List price \$18
 To order, please specify ASST/94N



Representations of Quantum Groups at a p -th Root of Unity and of Semisimple Groups in Characteristic p : Independence of p

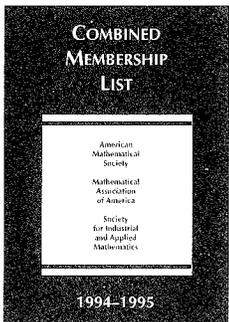
H. H. Andersen, J. C. Jantzen, and W. Soergel
 Volume 220

Let R be an indecomposable finite root system and associate to it two families of objects: U_p , the quantized enveloping algebra at a p -th root of unity (where $p > 1$ is an odd integer prime to 3 if R is of type G_2); and G_p , the semisimple, connected, and simply connected algebraic group over an algebraically closed field of characteristic p (here p is any prime). Restricting to the case where p is greater than the Coxeter number h of R , consider the block of the trivial one-dimensional module for U_p and for G_p . The simple modules in this block are indexed by certain elements in the affine Weyl group of R . Suppose that L_w is the simple module indexed by w and that V_w is the Weyl module with head L_w . Rubenthaler shows that there are integers $d_{w,x}$ independent of p such that in the U_p case (respectively in the G_p case), $d_{w,x}$ is equal to the multiplicity of L_x as a composition factor of V_w for all $p > h$ (respectively, for all $p \gg 0$). This implies that if the Lusztig conjecture holds in the quantum case, then it holds for $p \gg 0$ in the prime characteristic case.

Titles in this series are published by the Société Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, Case 916-Luminy, F-13 288 Marseille cedex 9, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents

Introduction; Basic notations; The general setup; Module categories; Projective modules; Lifting projectives; Homomorphisms and simple modules; Filtrations, linkage, and blocks; Translation functors; Extensions in Rank 1 situations; A functor into combinatorics; Translations and combinatorics; Translations in Rank 1 situations; Translations of extensions; A specific choice of extensions; General combinatorial categories; Graded combinatorial categories; The main



Combined Membership List, 1994-1995

The *Combined Membership List (CML)* is a comprehensive directory of the membership of the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

There are two lists of individual members. The first is a complete alphabetical list of all members in all three organizations. For each member, the *CML* provides his or her address, title, department, institution, telephone

provides his or her address, title, department, institution, telephone

results; Gradings and Lusztig's conjectures; Graded representation categories and Koszulity; Examples of endomorphism algebras; Appendices; References; Notations.

1991 Mathematics Subject Classification: 20G05, 17B35, 17B37

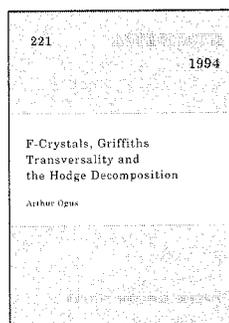
ISSN 0303-1179

321 pages (softcover), May 1994

AMS or SMF member \$45, List price \$50,

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SOCIÉTÉ MATHÉMATIQUE DE FRANCE,
ASTÉRISQUE



**F-Crystals, Griffiths
Transversality, and the
Hodge Decomposition**

Arthur Ogus

Volume 221

Pursuing the analogy between variations of Hodge structures in characteristic zero and F-crystals in characteristic p , Ogus introduces and studies the category of T-crystals, which are the crystalline manifestation of

modules with integrable connection and filtration satisfying Griffiths transversality. He constructs a functor from the category of F-crystals (or more generally F-spans) to the category of T-crystals, on any smooth logarithmic scheme in characteristic p . This functor is shown to commute with the formation of higher direct images—a generalization of Mazur's fundamental theorem on Frobenius and Hodge filtration to the case of crystalline cohomology with coefficients. Applications include results about Newton and Hodge polygons (Katz's Conjecture) and the degeneration of the Hodge spectral sequence (Hodge Decomposition), in both cases for the cohomology of a variety with coefficients in an F-crystal.

Titles in this series are published by the Société Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, Case 916-Luminy, F-13 288 Marseille cedex 9, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents

Introduction; Logarithmic structures and crystals; Transversality and divided power ideals; Griffiths transversality; Filtrations, bifiltrations, and gauges; T-crystals and F-spaces; Cohomology T-crystals; Cohomology of F-spans—Mazur's Theorem; Examples and applications.

1991 Mathematics Subject Classification: 14C30, 14D07, 14F17, 14F30, 11G25

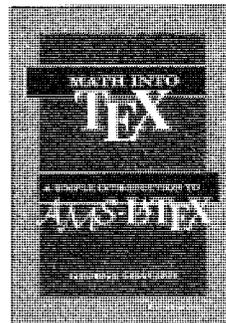
ISSN 0303-1179

183 pages (softcover), June 1994

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OTHER BOOKS AVAILABLE THROUGH AMS



**Math Into TeX: A
Simple Introduction
to AMS-LaTeX**

George Grätzer

Over the past ten years TeX has established itself as the premier tool for typesetting mathematics. LaTeX and AMS-TeX have made TeX more accessible. After several years of development, the American Mathematical Society has introduced AMS-LaTeX,

which combines the best features of LaTeX and AMS-TeX and makes this simplified introduction to TeX possible. George Grätzer's book provides the beginner with a simple and direct approach. Using many examples, a formula gallery, sample files, and templates, Part I guides the reader through setting up the system, typing simple text and math formulas, and creating an article template making it possible to start typing an article with only a few hours of training. Part II is a systematic discussion of all aspects of AMS-LaTeX and contains both examples and detailed rules. There are dozens of tips on how to interpret obscure "error messages", and how to find and correct errors. Part III and the Appendices take up more specialized topics that customize AMS-LaTeX. Even with no prior experience using any form of TeX, the mathematician, scientist, engineer, or technical typist, can begin preparing articles in a day or two using AMS-LaTeX. This book is truly unique in its focus on getting started fast and keeping it simple.

Published by Birkhäuser Boston.

Contents

Part I. A short course: *The structure of AMS-LaTeX; Typing your first article;*
Part II. A leisurely course: *Typing text; Typing math; The preamble and the topmatter; The body of the article; The bibliography; Multiline math displays; Displayed text;* **Part III. Customizing:** *Customizing AMS-LaTeX; TeX macros; Appendix A. Math symbol tables; Appendix B. Text symbol tables; Appendix C. AMS-LaTeX background; Appendix D. Keeping in touch; Appendix E. PostScript fonts; Appendix F. Conversions; Appendix G. Final word; Bibliography; Index.*

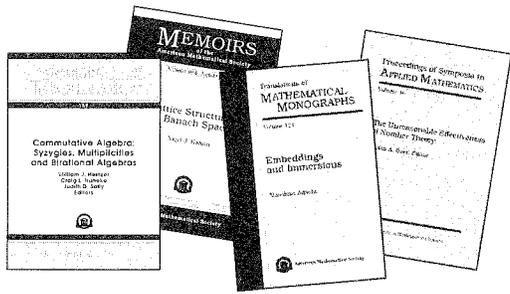
1991 Mathematics Subject Classification: 00

LC 92-6320

294 pages (softcover), 1993

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Publications of Continuing Interest

Following are some of our more popular books and videotapes as well as some with similar topics to those appearing in the New Publications section of this issue.

	List	Inst. mem.	Indiv. mem.
Chaos and Fractals: The Mathematics Behind the Computer Graphics , edited by Robert L. Devaney and Linda Keen, 0-8218-0137-6, 148 pages (hardcover). To order, please specify PSAPM/39NP	\$36	\$29	\$22
Chaotic Numerics , edited by Peter E. Kloeden and Kenneth J. Palmer, 0-8218-5184-5, 278 pages (softcover). To order, please specify CONM/172NP	51	41	31
The Emergence of the American Mathematical Research Community, 1876–1900: J. J. Sylvester, Felix Klein, and E. H. Moore , by Karen Hunger Parshall and David E. Rowe, 0-8218-9004-2, 500 pages (hardcover). To order, please specify HMATH/8NP	100	80*	60*
Harmonic Analysis Techniques for Second Order Elliptic Boundary Value Problems , by Carlos E. Kenig, 0-8218-0309-3, 146 pages (softcover). To order, please specify CBMS/83NP	30	30	18**
Hopf Algebras and Their Actions on Rings , by Susan Montgomery, 0-8218-0738-2, 238 pages (softcover). To order, please specify CBMS/82NP	34	34	20**
How to Teach Mathematics: a personal perspective , by Steven G. Krantz, 0-8218-0197-X, 76 pages (softcover). To order, please specify HTMNP	21	17	13
How to Write Mathematics , by N. E. Steenrod, P. R. Halmos, M. M. Schiffer, and J. E. Dieudonné, 0-8218-0055-8, 64 pages (softcover). To order, please specify HWMNP	17	14	10
The Integrals of Lebesgue, Denjoy, Perron, and Henstock , by Russell A. Gordon, 0-8218-3805-9, 395 pages (hardcover). To order, please specify GSM/4NP	59	47	35
An Introduction to Gröbner Bases , by William W. Adams and Philippe Loustau, 0-8218-3804-0, 289 pages (hardcover). To order, please specify GSM/3NP	49	39	29
The Joy of T_EX, A Gourmet Guide to Typesetting with the A_MS-T_EX Macro Package , Second Edition, by M. D. Spivak, 0-8218-2997-1, 309 pages (softcover). To order, please specify JOYTNP	40	36	32
L^AT_EX: A Document Preparation System , Second Edition, by Leslie Lamport, 0-201-52983-1, 235 pages (softcover). To order, please specify LATEXNP	35	35	35
Mathematics and Sports , by L. E. Sadovskii and A. L. Sadovskii, 0-8218-9500-1, 152 pages (softcover). To order, please specify MAWRLD/3NP	24	19	14
Research in Collegiate Mathematics Education. I , edited by Ed Dubinsky, Alan H. Schoenfeld, and Jim Kaput, 0-8218-3504-1, 229 pages (softcover). To order, please specify CBMATH/4NP	42	42	25**
Ten Lectures on the Interface Between Analytic Number Theory and Harmonic Analysis , by Hugh L. Montgomery, 0-8218-0737-4, 220 pages (softcover). To order, please specify CBMS/84NP	44	44	26**
Topological Invariants of Plane Curves and Caustics , by V. I. Arnold, 0-8218-0308-5, 60 pages (softcover). To order, please specify ULECT/5NP	30	24	18
What's Happening in the Mathematical Sciences , by Barry Cipra, 0-8218-8998-2, 51 pages (softcover). To order, please specify HAPPENING/2NP	8	8	8

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** All individuals.

Miscellaneous

Personals

George D. Byrne, formerly of the University of Pittsburgh and the Department of Mathematics of Southern Engineering Company, has been named professor and chairman of the Department of Mathematics at the Illinois Institute of Technology, Chicago, Illinois.

R. C. Gupta of the Birla Institute of Technology, Mesra, Ranchi, India, has been elected president of the Association of the Mathematics Teachers of India for a two-year term (1994 and 1995). In February 1994 Professor Gupta was also elected one of the vice-presidents of the Association for Improvement of Mathematics Teaching.

Jianxun He, formerly of Xiamen University, Xiamen, People's Republic of China, has been named senior associate at the International Center for Theoretical Physics, New York, New York.

Robert Lipto, of the Worcester Polytechnic Institute, has been named the recipient of the endowed Harold J. Gay Professorship in Mathematics. The Harold J. Gay Chair in Mathematical Sciences appointment is for two years and carries a stipend of \$1,000 per year for professional development. The award recognizes younger Worcester Polytechnic faculty members who have demonstrated potential for achievement in mathematics.

Joseph D. Petrucci, of the Worcester Polytechnic Institute, has been named recipient of the endowed John E. Sinclair Professorship. The three-year award, created in 1915, carries an annual stipend to be used for professional development.

H. M. Srivastava, of the University of Victoria, was conferred the title of Honorary Advisory Professor at Fudan University, People's Republic of China, on June 4, 1994.

Ram C. Tiwari, of the University of North Carolina at Charlotte, has been appointed chair of the Department of Mathematics at that institution for a period of three years, effective July 1, 1994.

John van Alstyne, Professor Emeritus of the Worcester Polytechnic Institute, has been awarded the William R. Grogan Award by the same institution. The Grogan Award is given occasionally to an individual who has demonstrated extraordinary contributions in support of the mission of the Worcester Polytechnic Institute and/or of the welfare of its students.

Deaths

Steven B. Bank, of the University of Illinois, died on April 10, 1994. He was born on March 14, 1939, and was a member of the Society for 33 years.

R. Cairol, of Ecole Polytechnique Federale, Lausanne, Switzerland, died on July 14, 1994. He was born on September 26, 1931, and was a member of the Society for 24 years.

Joseph Gillis, Professor Emeritus of the Weizmann Institute of Science, Rehovot, Israel, died on November 18, 1993. He was born in August 1911 and was a member of the Society for 53 years.

George (Djuro) Kurepa, Professor Emeritus of the University of Belgrade, Yugoslavia, died on November 2, 1993. He was born on August 16, 1907, and was a member of the Society for 43 years.

L. H. Loomis, Professor Emeritus of Harvard University, died on June 9, 1994. He was born in April 1915 and was a member of the Society for 55 years.

Frank J. Servedio, of Morristown, New Jersey, died on April 21, 1994. He

was born on July 13, 1940, and was a member of the Society for 31 years.

Franco Tricerri, of the University Degli Studi, Florence, Italy, died on June 6, 1994. He was born on October 1, 1947, and was a member of the Society for 15 years.

Zhigang Zhang, of the University of Montana, died on April 21, 1994. He was born on July 28, 1962, and was a member of the Society for 2 years.

Visiting Mathematicians

Supplementary List

Mathematicians visiting other institutions during the 1994–1995 academic year have been listed in recent issues of the *Notices*: May/June 1994, pp. 533–534; July/August 1994, p. 704; September 1994, p. 870.

Alexander Bendikov (Russia), University of Memphis, Probability, 8/94–8/95.

Pavel Drabek (Czech Republic), University of Memphis, Differential Equations, 8/94–1/95.

A. H. Goldie (England), University of Manitoba, Ring Theory, 10/94–11/94.

Willy Govaerts (Belgium), Cornell University, Applied Mathematics, Numerical Analysis, 9/94–12/94.

Andras Gyarfás (Hungary), University of Memphis, Graph Theory, 8/94–8/95.

Arun Jagota (India), University of Memphis, Neural Networks, 8/94–8/95.

O-Hun Kwon (Korea), Cornell University, Applied Mathematics, 8/94–8/95.

Huiying Sun (People's Republic of China), University of Memphis, Analysis, 4/94–5/95.

Hulin Wu (People's Republic of China), University of Memphis, Statistics, 8/94–8/95.

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- Zheng Rong Hui, Qian Ting School, Fujian, People's Republic of China
- Toshiaki Itoh, Kobe Univ, Japan
- Grigorii Ivanovich Ivchenko, Moscow, Russia
- Innho Jee, Bayside, NY
- Earle Willis Jennings, Richardson, TX
- Rolando Jimenez-Benitez, Univ National Autonoma de Mexico, Mexico
- Saroja P Kanchi, General Motors Engineering & Management Institute, Flint, MI
- Alexander Kanevskii, Latvian Academy of Sciences, Riga
- Anatoliy Israilevich Kaplinsky, Voronezh, Russia
- Alexander V Karzanov, Russian Academy of Sciences, Moscow
- Samvel S Kazarian, Institute of Mathematics, Erevan, Armenia
- Mati Kilp, Tartu, Estonia
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- Michael P Ryan, Tarrytown, NY
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- Leona H Sparaco, Endwell, NY
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- Don H Tosh, Evangel College, Springfield, MO
- Sandra Davis Trowell, Atlanta, GA
- Alexander Turbiner, Institute of Theoretical & Experimental Physics, Moscow, Russia
- Thomas P Turiel, Schenectady, NY
- Josep Lluis Uso-Domenech, Univ of Jaume I, Castellon, Spain
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Listed below are the Honorary Members of the American Mathematical Society, those who have been members for fifty years or more. The American Mathematical Society offers congratulations to all its Honorary Members on their longstanding affiliation with the AMS and extends appreciation for their continued commitment to the mathematics profession.

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Horace Komm	Ivan Niven	Abraham Spitzbart	

Stipends for Study and Travel

Items marked with a • are repeated from the October 1993 issue with only a change in the year; the resulting announcement has not yet been confirmed by the sponsoring agent.

Graduate Support

American Association for the Advancement of Science. Summer Fellowship. Provides support for twenty-five outstanding graduate students in the natural and social sciences and engineering as reporters, researchers, and production assistants in the mass media for ten weeks during the summer with a \$400/week stipend. (Exceptional undergraduate or postdoctoral students will also be considered.) Fellows will work for radio and television stations, newspapers, and magazines and will have their travel expenses and stipends paid by the AAAS. Fellows will have the opportunity to: observe and participate in the process by which events and ideas become news, improve their communication skills by teaming to describe complex technical subjects in a manner understandable by the public, and increase their understanding of editorial decision making and the manner in which information is effectively disseminated. Each fellow will: attend an orientation and evaluation session in Washington, DC; begin the internship in mid-June; and submit an interim and final report to AAAS to help evaluate the program. Interested students should write for more information and application procedures to: Amie E. Hubbard, Coordinator, Mass Media Science and Engineering Fellows Program, American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005. Application deadline will be about January 15, 1995.

American Association of University Women (AAUW) Educational Foundation. American Fellowships. Postdoctoral, dissertation, and summer postdoctoral faculty fellowships for women who are citizens or permanent residents of the U.S. Applicants for the postdoctoral fellowships must hold a doctoral degree by the application deadline, November 16. The Founders Fellowship provides \$25,000 for a senior scholar in any field; other fellowships provide \$20,000–\$25,000, and some have disciplinary restrictions. The dissertation fellowships provide stipends of \$14,500 for the final year of

writing the dissertation. An applicant must have completed all coursework, passed all examinations, and have had the dissertation proposal or plan approved by the application deadline. For more information contact: AAUW Educational Foundation, American Fellowships, P.O. Box 4030, Iowa City, IA 52243-4030; telephone: 319-337-1716; fax: 319-337-1204.

American Association of University Women (AAUW) Educational Foundation. Career Development Grants. These grants are intended to support women who are continuing their self-development through higher education. Funding is provided to women who are preparing themselves to reenter the work force, change careers, or advance a current career. Special consideration is given to AAUW members who submit qualified applications. Preference is given to applicants pursuing nontraditional coursework. These grants are one-time only awards. Minority women are encouraged to apply. Candidate eligibility: These grants are open to women who: are U.S. citizens or permanent residents; hold a baccalaureate degree; have received last degree five or more years ago; plan to pursue coursework at a fully accredited two- or four-year college or university or at a technical school that is licensed, accredited, or approved by the federal Veterans Administration; and enroll in courses that are prerequisites for professional employment plans. Funds are provided for tuition, fees, books, transportation (to/from/at school), and dependent care. Funds are not available for the final year of terminal degree professional programs (i.e., MBA, JD, MD, etc.). Ph.D. candidates may apply only for funding for coursework, not for dissertation research or writing. Candidates who fulfill eligibility requirements of other fellowship programs offered by the AAUW Educational Foundation **will not be considered** for funding from this grant and therefore must apply to the appropriate program. Deadline: January 3, 1995. Award Range: \$1,000–\$5,000. AAUW Educational Foundation, Career Development Grants, P.O. Box 4030, Iowa City, IA 52243-4030.

American Association of University Women (AAUW) Educational Foundation. Eleanor Roosevelt Teacher Fellowship. Created as the first programmatic component of the Eleanor Roosevelt Fund for Women and Girls, the purpose is twofold. First, it recognizes and rewards good teachers, and

second, it enables teachers to improve their ability to teach girls. Candidate eligibility: This program is open to full-time female classroom teachers who: are U.S. citizens or permanent residents; teach at U.S. public schools in grades K-12; teach math, science, or technology as at least part of their teaching assignment; have at least three consecutive years full-time teaching experience; plan to continue teaching for the next five years; and can demonstrate commitment to educational opportunities for women and girls through work in the classroom, the school district, and the community. Award range: \$1,000-\$10,000. The amount of the award depends on the scope of the activities outlined in the study plan and implementation plan. Teachers are not required to have sabbaticals from the school district. Coursework and/or research can be conducted during the summer or part-time. AAUW Educational Foundation, ERF Teacher Fellowships, Fellowships and Grants, Iowa City, IA 52243-4030; telephone: 319-337-1716.

American Association of University Women (AAUW) Educational Foundation. *Selected Professions Fellowships.* These are awarded to women who are citizens or permanent residents of the U.S. in designated fields. The fields of law, medicine, and the MBA program are open to minority women only. Fellowships for master's degree candidates, including those enrolled in one-year programs, are available for the final year of study in computer/information science, mathematics/statistics, architecture, and engineering (includes, for engineering only, the final year of Ph.D.). The fellowships, which range from \$5,000 to \$9,500, are for full-time study. The deadline is December 15 for all fields of study except MBA (February 1) and Engineering Dissertation (November 15). For more information, contact: AAUW Educational Foundation, Selected Professions Fellowships, 2201 North Dodge St., P.O. Box 4030, Iowa City, IA 52243; telephone 319-337-1716; fax 319-337-1204.

- **American Society for Engineering Education.** *ONR Graduate Fellowship Program.* About fifty 36-month fellowships will be granted by the Office of Naval Research to support study and research leading to a doctoral degree in one of the following fields: electrical engineering, computer science, naval architecture and ocean engineering, materials science, applied physics, aerospace/mechanical engineering, oceanography, mathematics, biological/biomedical sciences, cognitive/neural sciences, and chemistry. Applicants must be citizens of the U.S. (of any age) who have not attended graduate school since receiving their baccalaureate degree. The fellowships, tenable at U.S. institutions offering doctoral degrees in the designated science and engineering disciplines, offer a stipend of \$15,000 per 12-month year. In addition, ONR will provide the affiliated institution, on behalf of each Fellow, full tuition and fees and will provide \$2,000 per year to the Fellow's department. The application deadline is January 15, 1995. Application materials are available from the American Society for Engineering Education (ASEE), Eleven Dupont Circle, Suite 200, Washington, DC 20036; 202-986-8516 or 202-986-8525.

American Statistical Association (ASA). See listing in the Postdoctoral Support section for information.

Associated Western Universities, Inc. (AWU). AWU is a grantee to the U.S. Department of Energy, providing fellowships for faculty members and students who desire to become involved in energy-related research at one of the cooperating DOE laboratories or centers in the western U.S. For information telephone or write to Associated Western Universities, Inc., 4190 South Highland Drive, Suite 211, Salt Lake City, UT 84124; 801-278-0799.

Bunting-Cobb Graduate Residential Fellowships for Women. Women graduate students enrolled in math, science, or engineering programs at Rutgers University's Graduate School on its New Brunswick campus have a special opportunity. Douglass College, the largest women's college in the nation, offers the Bunting-Cobb Graduate Residential Fellowship program. The Fellowship includes stipends ranging from \$2,000 to \$5,000 depending on duties as well as room and board for the academic year in the Bunting-Cobb Math, Science, and Engineering Hall (estimated 1994-1995 figures). Bunting-Cobb Fellows serve as mentors to the undergraduates in the residence hall. The hall is equipped with a microcomputer room and a resource library. For information about the Bunting-Cobb Fellowship, please contact Dr. Ellen F. Mappen, Director, Douglass Project for Rutgers Women in Math, Science, and Engineering at 908-932-9197. For information about graduate study at Rutgers, please contact Ms. Beverly Tarter at 908-932-7711.

California State Graduate Fellowships. The state offers fellowships of up to \$6,490 to cover tuition and fees only for residents of California who attend accredited graduate or professional schools located in California with the intent to become college or university faculty members. Write to California Student Aid Commission, Graduate Fellowship Program, P.O. Box 510621, Sacramento, CA 94245-0621. The application deadline for 1995-1996 awards is March 2, 1995.

- **The CNA Corporation.** *Summer Employment.* CNA is engaged in a broad spectrum of operations research and systems analysis studies for the U.S. Navy, Marine Corps, and other government agencies. Opportunities are available for graduate students in operations research, economics, engineering, mathematics, physics, and statistics. Assignments include analysis related to force level planning, manpower, logistics, and operational effectiveness. U.S. citizenship required. Submit resume to Mr. Paul M. Moke, Employment Manager, Center for Naval Analyses, 4401 Ford Avenue, Alexandria, VA 22302-0268.

Committee on Institutional Cooperation. *CIC Predoctoral Fellowships in the Natural Sciences, Mathematics, and Engineering.* Fellowships are offered to African Americans, Native Americans (with tribal affiliation), Mexican Americans, and

Puerto Ricans for graduate study leading to the Ph.D. The fellowships provide full tuition plus an annual stipend of at least \$11,000 for at least four academic years. They may be used at any of these participating institutions: University of Chicago, University of Illinois at Urbana-Champaign, University of Illinois-Chicago, Michigan State University, University of Minnesota, Northwestern University, Ohio State University, Pennsylvania State University, Purdue University, University of Wisconsin-Madison, and University of Wisconsin-Milwaukee. Applicant must be a U.S. citizen and must hold or receive a bachelor's degree by August 1994 from a regionally accredited college or university. The deadline for applications for the 1995-1996 academic year is December 1, 1994. Applications and further information may be obtained from the Committee on Institutional Cooperation (CIC) Predoctoral Fellowships Program, 803 E. Eighth Street, Indiana University, Bloomington, IN 47405. From outside Indiana call toll-free 800-457-4420. In Indiana call 812-855-0823. Fax: 812-855-8741.

East Tennessee State University. Teaching Assistantships. East Tennessee State University offers a M.S. in Mathematical Sciences and offers seven teaching assistantships each year. The stipend is \$5,000 for nine months or \$7,000 for twelve months, and the duties are staffing the math lab for the first year and teaching two freshman courses for the second year. The climate is ideal and the people are easy to get along with. Respond to: Rick Norwood, e-mail: NORWOODR@ETSUSERV.EAST-TENN-ST.EDU.

Fellowships in Mathematics and Molecular Biology. The Program in Mathematics and Biology has graduate and postdoctoral fellowship support available but requires that there be both a mathematical and a biological component in the proposal. Current topics in the Program include geometry and topology of nucleic acids, sequence analysis of DNA, molecular dynamics, mapping functions and algorithms for DNA, and protein structure prediction. Other areas with both a mathematical and biological component will be considered. Fellowships can be held at any university or college in the United States. Application deadline is February 1, 1995. Women and minorities are encouraged to apply. Funding can begin between July 1, 1995, and November 1, 1995. For information and application materials contact: Program in Mathematics and Molecular Biology, 103 Donner Laboratory #3206, University of California, Berkeley, CA 94720; e-mail: sylviaj@violet.berkeley.edu; fax: 510-642-4071.

Florida Education Fund. The McKnight Doctoral Fellowship Program. McKnight Doctoral Fellowship provides up to \$5,000 in tuition and fees plus an annual stipend of \$11,000 to twenty-five African American citizens to pursue Ph.D. degrees at participating Florida universities. Applicants must hold or be receiving a bachelor's degree from a regionally accredited college or university. Contingent upon successful academic progress, the maximum length of the award is five years. The Florida Education Fund provides the first three years, and the

student's university continues funding at the same level of support for an additional two years. Detailed information and application packets can be obtained by writing or calling: The Florida Education Fund, 201 E. Kennedy Boulevard, Suite #1525, Tampa, FL 33602; 813-272-2772. The deadline for applications for fall 1995 is January 15, 1995.

Ford Foundation Predoctoral and Dissertation Fellowships for Minorities. Predoctoral and dissertation fellowships consisting of annual stipends of \$11,500 and \$18,000 respectively are available to minorities enrolled in research-based doctoral programs in mathematics, engineering, and other fields. These will be offered on a competitive basis to individuals who are citizens or nationals of the U.S. and who are members of the following groups: Alaskan Natives (Eskimo or Aleut), Native American Indians, Black/African Americans, Mexican Americans/Chicanos, Native Pacific Islanders (Polynesian or Micronesian), and Puerto Ricans. The predoctoral awards also include an allowance to the awardee's university in lieu of tuition and fees. Students interested in the 1995 doctoral fellowships may obtain application materials from the Fellowship Office, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418. The deadline for applications is early November 1994. Students interested in the 1995 predoctoral and dissertation fellowships should contact The Fellowship Office at the above address or call 202-334-2872.

Georgia Institute of Technology. President's Fellowships. These stipends of \$4,000 for twelve months are awarded to a selected number of highly qualified U.S. nationals who intend to pursue doctoral degrees. The awards are highly competitive; selection is based on academic criteria and evidence of scholarship. Participants are expected to maintain high academic standing. The Fellowships are intended to supplement other forms of support and can be extended for three additional years based on academic performance and research potential. *Graduate Research/Teaching Assistantships.* These awards pay \$12,000 per twelve months, plus waiver of all tuition and fees. Appointments are based primarily on scholarship and ability to contribute to ongoing programs of the school. Prospective students who consider themselves highly qualified for an award should include with their application for admission a letter describing in as much detail as possible their qualifications and needs. Write to the Ph.D. Coordinator, College of Computing, Georgia Institute of Technology, Atlanta, GA 30332-0280.

Daniel and Florence Guggenheim Foundation. Fellowships for U.S. and Canadian residents interested in jet propulsion, energy conversion, fluid mechanics, and flight structures. For information on flight structures, write to the Department of Civil Engineering and Engineering Mechanics, Columbia University. For information on applied physics and materials science; dynamics and control systems; energy conversion, propulsion, and combustion; energy and environmental policy; flight science and technology; and fluid mechanics, and

computational and experimental fluid mechanics, write to the Director of Graduate Studies, Department of Mechanical and Aerospace Engineering, Princeton University, Princeton, NJ 08544.

Fannie and John Hertz Foundation Fellowships. The stipend is \$17,000, plus \$12,000 cost-of-education allowance (\$8,000 at M.I.T) per nine-month year. Offered on the basis of academic (A- undergraduate GPA) and research performance, recommendations, and personal technical interview for the support of personal and institutional expenses during graduate education directed toward the Ph.D. degree in applied physical sciences. Tenable at the Department of Applied Science of the Davis Campus and at all campuses of the University of California; California Institute of Technology; Carnegie-Mellon University; The University of Chicago; Cornell University; Courant Institute of Mathematical Sciences, New York University; Georgia Institute of Technology; Harvard University; Johns Hopkins University; University of Illinois at Urbana-Champaign; Massachusetts Institute of Technology; University of Minnesota; Polytechnic Institute of New York; Princeton University; Rensselaer Polytechnic Institute; Rice University; University of Rochester; Stanford University; University of Texas at Austin; Texas A&M University; Vanderbilt University; University of Washington, Seattle; University of Wisconsin, Madison; and Yale University, New Haven, Connecticut. Application deadline is October 21, 1994. Applicants should write to the Office of the Graduate Dean at these institutions or write directly to the Hertz Foundation, Box 5032, Livermore, CA 94551-5032.

Hubert H. Humphrey Doctoral Fellowships. Awards are made by the U.S. Arms Control and Disarmament Agency (ACDA) to stimulate interest in the study of arms control in universities around the country by supporting unclassified doctoral dissertation research in the field. Applicants must be U.S. citizens or nationals and must have completed all requirements for the doctorate, except the dissertation, at a U.S. college or university. (Law students are also eligible.) The stipend will be \$5,000 for a 12-month period, plus applicable tuition and fees of up to \$3,400 for one year. Application deadline is March 15 for the 12-month award period beginning in either September or the following January. For application materials write: Hubert H. Humphrey Fellowship Program, U.S. Arms Control and Disarmament Agency, Washington, DC 20451.

• **Hughes Aircraft Company Fellowships.** Masters and Doctoral Fellowships are awarded on a competitive basis to qualified individuals in Engineering and Science for study at selected universities in the fields of electrical, mechanical, aerospace or systems engineering, computer science, mathematics, or physics. Most are awarded on a work-study basis. U.S. citizenship is required. GPA must be at least 3.0/4.0. Write to the Hughes Aircraft Company, Corporate Fellowship Office, Technical Education Center, P.O. Box 80028, Bldg. C1/B168, Los Angeles, CA 90080-0028.

• **Kosciuszko Foundation.** Scholarships and grants for Americans of Polish background. Eligibility: (1) Full-time graduate students in the U.S., (2) U.S. citizens of Polish descent, (3) Poles who are permanent residents of the U.S., and (4) Americans of non-Polish descent who are pursuing studies/research relating to Polish subjects. Scholarships are granted for one year. Consideration is given to financial need of each applicant. Application deadline is January 15, 1995. For information write to Scholarship and Exchange Programs, The Kosciuszko Foundation, 15 East 65th Street, New York, NY 10021-6595; 212-734-2130; fax: 212-628-4552.

Laboratory Graduate Participation. Supports full-time thesis and dissertation research at participating DOE research facilities for M.A. and Ph.D. candidates majoring in the life, physical, and social sciences; mathematics; and engineering. Applicants must be U.S. citizens who have completed all requirements for the degree except thesis or dissertation research. The annual stipend is \$12,000–\$14,400 plus certain tuition and fees and additional allowances for dependents. Additional information and application materials may be obtained from Science/Engineering Education Division, Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, TN 37831-0117.

National Science Foundation. Graduate Research Fellowships. Three-year awards available to citizens or nationals of the U.S. and permanent residents for full-time study leading to master's or doctoral degrees in science (including mathematics) and engineering. Awards made only to students who have completed no more than twenty semester hours or thirty quarter hours of graduate study in science or engineering. Stipends of \$14,000 proposed for 1995–1996 for a 12-month tenure. No dependency allowances. Education allowance paid to fellowship institution. Application deadline is early November. Mail request to: Oak Ridge Associated Universities (ORAU), P.O. Box 3010, Oak Ridge, TN 37831-3010.

National Science Foundation. Minority Graduate Research Fellowships. Awarded for study or work leading to the master's or doctoral degrees, these fellowships are granted for periods of three years. They are open to U.S. citizens or nationals or permanent residents who are members of an ethnic minority group underrepresented in the advanced levels of the U.S. science personnel pool, i.e., American Indian, Native Alaskan (Eskimo or Aleut), Black/African American, Hispanic, or Native Pacific Islander (Polynesian or Micronesian). Awards made only to students who have completed no more than thirty semester hours or forty-five quarter hours of graduate study in science or engineering. The stipend is \$14,000 proposed for 1995–1996 for 12-month tenures. No dependency allowances. Education allowance paid to fellowship institution. The deadline for applications is early November. Mail request for application materials to: Oak Ridge Associated Universities (ORAU), P.O. Box 3010, Oak Ridge, TN 37831-3010.

• **Office of Naval Research. Graduate Fellowship Program.** ONR will award up to fifty 36-month fellowships for study and research at U.S. institutions offering doctoral degrees in specified engineering, science, and math disciplines. Participants must be U.S. citizens. Fellows selected in 1995 will receive \$15,000 for the first year of tenure. ONR will pay the institution full tuition and fees and provide \$2,000 to the Fellow's department. ONR Fellowships awarded in this eleventh year of the program will be for study and research in eleven major disciplines: electrical engineering, computer science, naval architecture and ocean engineering, materials science, applied physics, aerospace/mechanical engineering, biological/biomedical sciences, cognitive/neural sciences, mathematics, chemistry, and oceanography. Deadline for applications is January 15, 1995. Application materials may be obtained from the American Society for Engineering Education (ASEE), 11 Dupont Circle, Suite 200, Washington, DC 20036; 202-986-8516 or 202-986-8525.

Purdue University. Frederick N. Andrews Fellowships, Graduate Opportunity Fellowships, and Teaching Fellowships. *Andrews Fellowships:* The stipend is \$15,000 for twelve months with tuition and fees remitted except for \$253 per semester and \$126.50 for summer session. Fellowships are renewable for one year upon satisfactory performance in coursework. Fellows may hold additional University employment up to one-quarter time as teaching or research assistants. *Graduate Opportunity Fellowships:* The stipend is \$15,000 for twelve months with all tuition and fees remitted. Fellowships are renewable for up to two years upon satisfactory performance in coursework. Fellows may hold additional University employment up to one-quarter time, as teaching or research assistants. *Teaching Fellowships:* The stipend is at least \$1,000 per month for twelve months with tuition and fees remitted except for \$253 per semester and \$126.50 for summer session. Fellows usually teach four to six hours per week. Duration is three years during which fellows are given two semesters or one semester and two summers free from all teaching duties. For application forms and information, write to Graduate Office, Department of Mathematics, 1395 Mathematical Sciences Building, Purdue University, West Lafayette, IN 47907-1395; e-mail: gcomm@math.purdue.edu.

Sigma Delta Epsilon, Graduate Women in Science. Awards of \$1,500 - \$4,000 for one year, nonrenewable, are available on a competitive basis to those who hold a degree from a recognized institution of higher learning in all the natural sciences (physical, environmental, mathematical, computer and life sciences) and are currently involved in research or have an approved research proposal. Appointments will be made irrespective of race, nationality, creed, or age. Applications from women are especially encouraged. Application deadline is December 1. Announcement of awards will be made by the following July 1. Further information and application forms may be obtained from Sigma Delta Epsilon, Graduate Women in Science, Inc., P.O. Box 19947, San Diego, CA 92159 (please send self-addressed envelope with 52¢ postage).

University of California, Los Angeles. Biostatistical Training in AIDS. The UCLA Department of Biostatistics has traineeships in AIDS which pay all tuition fees and a monthly stipend. We offer support to both predoctoral and postdoctoral students. Training leading to the doctorate includes courses in biostatistics, mathematical statistics, and AIDS and provides collaboration experiences with AIDS researchers. Postdoctoral fellowship training is arranged specifically for each fellow. Fellows with doctorates in biostatistics or statistics will take the AIDS courses, collaborate with AIDS researchers, and work on their own statistical research projects. Postdoctoral fellows with a doctorate in other fields will take biostatistics courses, AIDS courses, and work on their own research projects. This federally funded program requires permanent residence in the U.S. or U.S. citizenship. We encourage applications from qualified women and minority candidates. AA/EOE. Contact: Dr. Jeremy M. G. Taylor, UCLA Department of Biostatistics, Los Angeles, CA 90024-1772.

Zonta International Foundation. Amelia Earhart Fellowship Awards. Established in honor of Amelia Earhart, Zonta member from 1928–1937, the fellowships recognize excellence and encourage and support women in aerospace-related science and engineering. Thirty-five \$6,000 grants to women for graduate study in aerospace-related science or engineering are awarded annually. To qualify for the fellowship, a woman must have by the time of her application: a bachelor's degree in a qualifying area of science or engineering which is closely related to advanced studies in the aerospace-related sciences; a superior academic record and evidence of potential at a recognized institution of higher learning as demonstrated by transcripts, recommendations, and acceptance or verification by an institution of higher learning with accredited courses in aerospace-related studies; and completion of one year of graduate school at a well-recognized institution of higher learning or evidence of a well-defined research and development program as demonstrated by publications or a senior research project. Application forms must be received by November 1, 1994, with all supporting documentation received by November 7, 1994. Announcements of awards will be made by May 15, 1995. For more information: Zonta International, 557 W. Randolph St., Chicago, IL 60661-2206; 312-930-5848; fax: 312-930-0951.

Postdoctoral Support

Air Force Office of Scientific Research. Research Contracts and Grants. Mathematicians and computer scientists are encouraged to submit proposals for research support through their organizations. Research areas include mathematics of dynamics and control, physical mathematics and applied analysis, computational mathematics, optimization and discrete mathematics, signal processing, probability and statistics, software and systems, artificial intelligence, and electromagnetics. Research proposals should be forwarded to the Director of Mathematics and Geosciences, Air Force

Office of Scientific Research (AFOSR NM), 110 Duncan Avenue, Suite B115, Bolling AFB, DC 20332-0001.

American Association for the Advancement of Science. *1995–1996 Congressional Science and Engineering Fellowships.* Fellows spend one year working as special legislative assistants on the staffs of members of Congress or congressional committees, beginning in September 1995. The program includes an orientation on congressional and executive branch operations and a year-long seminar program on issues involving science and public policy to provide a unique public policy learning experience, to demonstrate the value of such science-government interaction, and to make practical contributions to the more effective use of scientific and technical knowledge in government. A prospective fellow must demonstrate exceptional competence in some area of science or engineering, have a good scientific and technical background, and have a strong interest and some experience in applying personal knowledge toward the solution of societal problems. Candidates should be postdoctoral to midcareer scientists or engineers. AAAS will sponsor two Fellows. The stipend is \$40,000 plus an allowance for relocation and travel expenses. Deadline for receipt of applications by AAAS is January 15, 1995. American Association for the Advancement of Science, 1333 H. St., NW, Washington, DC 20005; 202-326-6600.

American Association for the Advancement of Science. *Science, Engineering and Diplomacy Fellowships.* One-year fellowships are available for work as staff officers in the State Department and in the Agency for International Development. The Fellow must demonstrate exceptional competence in some area of science or engineering, be flexible, and have a strong interest or some experience in applying knowledge toward the solution of problems in the area of foreign affairs. A secret security clearance must be obtained after selection. Salaries are at the GS12 level depending upon education and experience. Deadline for receipt of applications is January 15. For application materials and more specific information on assignment possibilities, write to Science, Engineering and Diplomacy Fellows Program, AAAS, 1333 H Street, NW, Washington, DC 20005.

American Association for the Advancement of Science. *Summer Environmental Science and Engineering Fellows Program.* Fellows will spend ten weeks working as special research consultants with the Office of Research and Development (ORD) of the U.S. Environmental Protection Agency (EPA) in Washington, DC. Fellows will undertake a detailed, future-oriented research project of mutual interest to the Fellow and one of EPA's research or program offices and prepare a report at the completion of the summer's work. The program includes a week-long orientation to EPA and relevant congressional and executive branch operations, as well as a weekly seminar program on environmental issues and science, technology, and public policy. The purpose of the fellowship program is to assist ORD in identifying and assess-

ing the significance of long-range environmental problems and opportunities. Prospective Fellows must be postdoctoral to midcareer professionals, show exceptional competence in a relevant professional area, have a broad professional background, and have a strong interest and some experience in applying scientific or other professional knowledge toward the identification and assessment of future environmental problems. Persons may apply from any physical, biological, or behavioral science field, any field of engineering, or any other relevant professional field. Applicants must be residents of the U.S. The stipend is \$950 per week plus nominal relocation and travel expenses. The deadline for receipt of applications is January 15, 1995. American Association for the Advancement of Science, 1333 H. St., NW, Washington, DC 20005; 202-326-6600.

American Association of University Women (AAUW) Educational Foundation. *American Fellowships.* See the listing in the Graduate Support section for information.

American Association of University Women (AAUW) Educational Foundation. *Career Development Grants.* See the listing in the Graduate Support section for information.

American Mathematical Society Centennial Fellowships. *Postdoctoral Fellowships.* These fellowships are intended to provide enhanced research opportunities to mathematicians who are several years past the Ph.D., who have a strong research record, but who have not had extensive postdoctoral research support in the past. Applicants should have received the Ph.D. degree between January 1, 1983, and December 31, 1988, and should not have had the equivalent of more than two years of full-time postdoctoral support. (For the purpose of counting, it should be mentioned that a Sloan Fellowship or a Presidential Year Investigator [PYI] counts as one year of postdoctoral research support.) The stipend for fellowships awarded for 1995–1996 has been set by the Trustees of the Society at \$43,900 for nine months. In addition, there will be an expense allowance of \$1,435. Applicants must be citizens or permanent residents of a country in North America. The fellowship may be combined with other stipends and/or part-time teaching; this option can be used to extend the award to cover a period of up to two years. For further information about the acceptability of such arrangements, individuals should contact the secretary of the Society. The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Trustees have arranged a matching program from general funds in such fashion that funds for at least one fellowship are guaranteed. Because of the generosity of the AMS membership, it has been possible to award two or three fellowships a year for the past eight years. The deadline for receipt of applications is **December 1, 1994**. Awards will be announced in February 1995 or earlier if possible. For application forms, write to the Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940, or send electronic mail to ams@math.ams.org. (It should be noted that completed

application and reference forms should **NOT** be sent to this address, but to the address given on the forms.)

American Philosophical Society. Postdoctoral research grants of up to \$5,000 (averaging \$2,000) for candidates with Ph.D. for at least one year to aid specific research projects. Grants contribute toward travel expenses, food and lodging, and photoduplication. The purpose of the program is to connect scholars with the objects of their research. No funds are available for attending conferences or consulting with colleagues. Tenable abroad and in U.S. The Committee on Research meets in February, April, June, and October. For application forms, please briefly describe your project and proposed budget in a letter to: Committee on Research, American Philosophical Society, 104 South Fifth Street, Philadelphia, PA 19106.

American Society for Engineering Education. *NASA-ASEE Summer Faculty Fellowships.* Programs in science and engineering research in collaboration with the National Aeronautics and Space Administration research centers; for U.S. citizens who are faculty or research members (with at least two years experience) of institutions of higher education. Stipends will be \$1000/week for ten weeks, plus travel allowance. Application deadline is January 13, 1995. For published announcement write to NASA-ASEE Summer Faculty Fellowships, American Society for Engineering Education, 1818 N St., NW, Suite 600, Washington, DC 20036; 202-986-8525/202-986-8500.

American Society for Engineering Education. *Navy-ASEE Sabbatical Leave Program.* This program allows science and engineering faculty the opportunity to conduct research at Navy laboratories while on sabbatical leave. Participants in the program will receive a monthly stipend making up the difference between salary and sabbatical leave pay from their home institution. In addition, participants will receive reimbursement for travel to and from the laboratory site and a relocation allowance for those who must relocate their residence during their sabbatical leave tenure. Appointments must be for at least one quarter or semester. Applications for the program will be accepted four times a year—January 1, April 1, July 1, and October 1. For information write to: Navy-ASEE Faculty Research Programs Director, 1818 N St., NW, Suite 600, Washington, DC 20036.

American Society for Engineering Education. *Navy-ASEE Summer Faculty Research Programs.* Programs in math, science, and engineering research at the laboratories and R&D centers of the Navy; for U.S. citizens who are faculty or research members of institutions of higher education. Stipends will be given at various levels, plus travel and relocation allowances. Application deadline is January 2, 1995. For a program announcement write to Navy Summer Faculty Program, American Society for Engineering Education, 1818 N St., NW, Suite 600, Washington, DC 20036.

American Statistical Association (ASA). *Senior Research Fellowship Program.* The ASA/NSF/NIST Senior Research Fellowship Program, which is cosponsored by the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST), invites applications for Fellowships and Associateships at NIST during the 1995–1996 academic year, subject to continued NSF funding. The Fellowships are intended for senior researchers, while the Associateships are for advanced graduate students and recent Ph.D.s who are associated with the Senior Research Fellow applicant. In particular, the program seeks Fellows with a strong interest in cross-disciplinary research in process modeling and optimization. Areas of research that fit NIST's research mission and facilities include: Statistical approaches in materials measurement and processing technologies, studies of advanced manufacturing systems, computing for engineering and industrial statistics, and statistical image processing. Salaries of the Senior Research Fellows will be commensurate with qualifications and experience, and fringe benefits will be provided. Appointments will last three to nine months. Applications are due January 13, 1995, for Fellows and February 18, 1995, for Associates. For application information, contact Carolee Bush, ASA/NSF/NIST Research Program, American Statistical Association, 1429 Duke St., Alexandria, VA 22314-3402; 703-684-1221. For information on research topics and other aspects of the program, contact Susannah Schiller, Coordinator, ASA/NSF/NIST Research Program, Statistical Engineering Division, National Institute of Standards and Technology, Administration Bldg., Room A337, Gaithersburg, MD 20899; 301-975-2852. Women and minorities are encouraged to apply.

- **Argonne National Laboratory.** The Mathematics and Computer Science Division of Argonne National Laboratory invites applications for postdoctoral researchers. Argonne has strong research programs in scientific computing, software tools, computational mathematics, and applied analysis. There is special interest in numerical methods for linear algebra, optimization, and partial differential equations; software tools for parallel computing; and state-of-the-art numerical methods for computational science problems. The Mathematics and Computer Science Division also has an outstanding computational environment that includes access to high-performance scientific workstations, a scientific visualization laboratory, and state-of-the-art parallel computers (including the IBM SP-1 and the Intel Touchstone DELTA). Argonne is located in the southwestern Chicago suburbs, offering the advantages of affordable housing and good schools, as well as easy access to the cultural attractions of the city. Applicants must have received their Ph.D. not more than three years prior to the beginning of the appointment. Applications must be addressed to Walter McFall, Box mcs-postdoc3, Employment and Placement, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439, and must include a résumé and the names and addresses of three references. Argonne is an Affirmative Action/Equal Opportunity Employer.

The Bunting Institute of Radcliffe College. *Science Scholar Fellowships.* The Bunting Institute provides fellowships to postdoctoral scientists who have received the Ph.D. two years prior to appointment to work on projects that will make a contribution to their fields and advance their careers. Open to women scientists who are U.S. citizens in the fields: astronomy, molecular and cellular biology, biochemistry, chemistry, cognitive and neural science, computer science, electrical engineering, aerospace/mechanical engineering, geology, materials science, mathematics, physics, naval architecture and ocean engineering, oceanography, and all fields that relate to the study of oceans. Office space; stipend \$34,200 plus up to \$3,000 in research expenses; one-year appointment; access to Harvard/Radcliffe libraries and facilities. Deadline for applications is October 15, 1994 (postmarked). Write or call for application and information to: Science Scholar Fellowship Program, The Bunting Institute of Radcliffe College, 34 Concord Avenue, Cambridge, MA 02138; 617-495-8212.

- **California Institute of Technology.** *Harry Bateman Research Instructorships.* Offered by Mathematics at the California Institute of Technology. Open to men and women (of any age) who have recently received their doctorate in mathematics. Appointments are for one year and are renewable for one additional year. The annual salary for academic year 1995–1996 is \$38,000. Duties include teaching one course for the full academic year. Please send applications by January 1 to A. Kechris, Professor and Executive Officer for Mathematics, 253-37 Sloan Laboratory, Pasadena, CA 91125. Include CV and a statement of anticipated research. The candidate is requested to ensure that at least three letters of recommendation be sent to Caltech. Caltech is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

California Institute of Technology. *Olga Taussky-John Todd Instructorships in Mathematics.* Offered to persons within three years of having received the Ph.D. who show strong research promise in one of the areas in which Caltech's mathematics faculty is currently active. Initial appointments are for two years with a one-year terminal extension expected. The annual salary for 1994–1995 is \$40,000 per year plus a \$2,000 per year research fund. There are three terms in the Caltech academic year, and instructors are expected to teach one course in all but two terms of the total appointment. Apply by January 1 to the Olga-Taussky-John Todd Instructorships, 253-37 Sloan Laboratory, Pasadena, CA 91125. Include CV and a statement of anticipated research. The candidate is requested to ensure that at least three letters of recommendation be sent directly to Caltech. Caltech is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

Carnegie Mellon University. *Center for Nonlinear Analysis Postdoctoral Fellowships.* The Center for Nonlinear Analysis expects to make four or five postdoctoral appointments

for 1995–1996. These are one-year (twelve-month) appointments by the Center and the Department of Mathematics. Recipients will teach at most one course per semester. The Center engages in research in partial differential equations, the calculus of variations, nonlinear continuum mechanics, stochastic differential equations, stochastic control, numerical analysis, and scientific computation. The chief applications are to materials science, fluid dynamics, and stochastic models for production and communication processes. The Center is primarily supported by the Army Research Office, with additional support provided by the National Science Foundation. Applicants should submit a vita, list of publications, a statement describing current and planned research, and arrange to have at least three letters of recommendation submitted. The deadline for application is January 20, 1995. All communications should be addressed to: Postdoctoral Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon is an Affirmative Action/Equal Opportunity Employer.

Cornell University. Possible *H. C. Wang Assistant Professorship.* During one of the years, the holder of a Wang Assistant Professorship will have a teaching load of two courses in the first semester and one in the second; otherwise, it will be two courses per semester. Salary \$32,000. The Assistant Professorship is nonrenewable after a three-year term. Applications and letters of reference should be addressed to Recruiting Committee, Department of Mathematics, White Hall, Cornell University, Ithaca, NY 14853-7901.

Courant Institute. *K.O. Friedrichs Fellowship.* The Courant Institute of Mathematical Sciences at New York University is seeking applications for the K.O. Friedrichs Fellowship, a postdoctoral research fellowship in computational mathematics. Specific areas of interest include combustion, computational fluid dynamics, and parallel computing. The fellowship is supported by the Office of Scientific Computing of the Department of Energy. Candidates must be U.S. citizens or permanent residents. The appointment is for two years starting September 1995. Interested candidates should send a résumé, research statement, preprints or thesis if available, and the names of three references to: K.O. Friedrichs Fellowship Committee, Courant Institute, 251 Mercer Street, New York, NY 10012. The deadline for applications is February 1995.

- **Courant Institute.** *Visiting Memberships and Courant Institute Instructorships.* The Courant Institute is a center for advanced training and research in the mathematical sciences. It has long been a leader in mathematical analysis, applied mathematics, and computational science, with special emphasis on partial differential equations and their applications. Its scientific activities include an extensive array of research seminars and advanced graduate courses. Each year a limited number of positions are awarded to postdoctoral scientists. Applicants must have a Ph.D. in mathematics or an affiliated discipline. Preference is given to recent Ph.D.s. *Courant Institute Instructorships* are ordinarily for a two-year term, including

summer salary; they carry a teaching load of one course per semester. *Visiting Memberships* are ordinarily for a one-year term but carry no teaching duties; extension or renewal may be possible. For an application form and further information write to: Visiting Membership Committee, Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, NY 10012-1185. Applications for the 1995–1996 academic year are due by December 15, 1994. NYU is an Equal Opportunity/Affirmative Action Employer.

Dartmouth College. *John Wesley Young Research Instructorships.* Two instructorships are normally awarded by Dartmouth College each year. Teaching duties are one course for two quarters and two courses for one quarter (or two courses for two quarters) and are of a varied and nonroutine nature. The academic-year salary of \$35,000 is supplemented by a two-month resident research stipend of \$7,778, for a total of \$42,778. Appointments are for two years and are not renewable. Applicants should write to Department of Mathematics, Dartmouth College, Hanover, NH 03755-3551 (Attention: Recruiting). Applicants are advised to apply promptly and no later than January 15, 1995.

Fellowships in Mathematics and Molecular Biology. See listing in the Graduate Support section for information.

Ford Foundation Postdoctoral Fellowships for Minorities. Administered by the National Research Council, these fellowships are sponsored by the Ford Foundation. Applicants must be U.S. citizens who are members of one of the designated minority groups: American Indians and Alaskan Natives (Eskimo or Aleut), Black/African Americans, Mexican Americans/Chicanos, Native Pacific Islanders (Micronesians and Polynesians), or Puerto Ricans who are engaged in college or university teaching and hold a doctoral degree. Tenure of the one-year fellowship provides postdoctoral research experience at an appropriate nonprofit institution of the Fellow's choice. The stipend is \$25,000 with a travel and relocation allowance of \$3,000. No dependency allowance is available. The employing institution is encouraged to supplement the Fellow's stipend. The program will also provide a cost-of-research allowance of \$2,000 for each Fellow in residence that is meant as partial support for the Fellow's study and research program. The deadline for the submission of applications is January 1995. Further information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418; 202-334-2860.

Fulbright Scholar Program. The Fulbright Scholar Program includes 300 grants in research and 700 grants in university lecturing for periods ranging from two months to a full academic year. There are openings in over 135 countries with some opportunity for multicountry research. Fulbright awards are granted in virtually all disciplines. Scholars in all academic ranks, retired faculty, and independent scholars are eligible to apply. Benefits include a base stipend plus

allowances for housing, subsistence, travel, and other benefits. Basic eligibility requirements are U.S. citizenship; Ph.D. or comparable professional qualifications; university or college teaching experience for lecturing awards; and, for selected assignments, proficiency in a foreign language. Application deadline is August 1. For more information and applications, call or write Council for International Exchange of Scholars, 3007 Tilden St., NW, Suite 5M, Washington, DC 20008-3009; 202-686-7877.

The Geometry Center, University of Minnesota. *Postdoctoral Research and Training Fellowships.* The Geometry Center is the NSF Science and Technology Research Center for Computation and Visualization of Geometric Structures. The Center has created a unified mathematics computing environment supporting math and computer science research, mathematical visualization, software and tool development, application development, video animation production, and K–16 math education and outreach. Up to three fellowships will be awarded for the academic year 1995–96. They are for one year with the possibility of a one-year renewal by mutual agreement. Remuneration will be \$40,000/twelve months if there is no other support. Applicants are expected to demonstrate a high level of research accomplishment in mathematics or computer science and to be at home in a computing environment. Postdocs are expected to maintain a vigorous program of independent research. They are also expected to participate fully in the life of the Center, that is, to participate in activities in a combination of research, technology development, education, and outreach. To apply: send a vita; a summary of research accomplishments; documentation of computing experience; a research plan, indicating plans to make use of computing and graphics resources; and three references who are familiar with your work and whom you have asked to send letters of recommendation. Applications from underrepresented groups are specifically encouraged. Application materials should be sent by December 31, 1994, preferably by e-mail, to postdoc_app1@geom.umn.edu or by surface mail to Postdoc Applications, The Geometry Center, University of Minnesota, Suite 500, 1300 South Second Street, Minneapolis, MN 55454. The University of Minnesota is an Equal Opportunity educator and employer.

John Simon Guggenheim Memorial Foundation Fellowships. Fellowships are on an advanced professional level. U.S. or Canadian citizenship or permanent residence is required. Fellowships are also offered to citizens or permanent residents of Latin America and the Caribbean. Application deadline: October 1 for the U.S. and Canada competition, December 1 for the Latin American and Caribbean competition. Approximately 175 awards are made, averaging approximately \$27,000 in 1994. For more information write to John Simon Guggenheim Memorial Foundation, 90 Park Avenue, New York, NY 10016.

• **Harvard University.** *Benjamin Peirce Lectureships.* Rank of assistant professor. The appointments are for three years with

a starting salary of approximately \$42,200 (for the nine-month academic year) which can be augmented by teaching in the summer school or by working on a research contract if funds are available. The teaching commitment is three half-courses per year. Usually one of the half-courses will be on a topic of the lecturer's choice. Application forms may be obtained by writing to: Benjamin Peirce Lectureships, Department of Mathematics, Harvard University, One Oxford Street, Cambridge, MA 02138. Applications must be filed by December 30, 1994. Harvard is an Equal Opportunity/Affirmative Action Employer and particularly encourages applications from women and minority candidates.

Institute for Advanced Study Memberships. The School of Mathematics will grant a limited number of memberships, some with financial support, for research in mathematics at the Institute during the academic year 1995–1996. Candidates must have given evidence of ability in research comparable at least with that expected for the Ph.D. degree. Application blanks may be obtained from The School of Mathematics, Institute for Advanced Study, Princeton, NJ 08540, and should be returned (whether or not funds are expected from some other source) by December 1, 1994. An Equal Opportunity/Affirmative Action Employer.

Institute for Mathematics and its Applications (IMA). *Postdoctoral Memberships.* The IMA will award up to 15 12-month research memberships with starting date approximately September 1, 1995. The postdoctoral terms will include the academic-year program on Mathematical Methods in Materials Science, September 1995 to June 1996. All requirements for a doctorate should be completed by September 1, 1995. Applicants must show evidence of mathematical excellence, but they do not need to be specialists in the field. The following materials must be submitted: (1) personal statement of scientific interest, research plans, and reasons for wishing to participate in the Mathematical Methods in Materials Science program (this is an essential part of the application); (2) curriculum vitae and a list of publications; (3) three letters of recommendation, to be sent directly to the IMA. All material should arrive by January 13, 1995. *Senior memberships* are also available. Preference will be given to supplementary support for persons with sabbatical leaves, fellowships, or other stipends. All correspondence should be sent to: Visiting Membership Committee, Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street SE, Minneapolis, MN 55455-0436 U.S.A. The University of Minnesota is an Equal Opportunity educator and employer.

Institute for Mathematics and its Applications (IMA). *Postdoctorates in Industrial Mathematics.* The IMA will award up to 8 one-to-two year positions in industrial mathematics effective September 1, 1995. These appointments are in addition to the regular IMA 1995–1996 postdoctoral program in Mathematical Methods in Materials Science and are funded jointly by the NSF and by industry. They are designed to pre-

pare mathematicians for research careers involving industrial interaction. Applicants should have received their Ph.D. in Mathematics or Applied Mathematics by September 1, 1995. Familiarity with pde and/or numerical analysis is desired, but no knowledge in engineering is required. Postdoctorates will spend 50% effort in the IMA program and 50% effort working with scientists from industry on one of the following or related topics: (1) signal processing and computational ocean acoustics; (2) diffractive and nonlinear optics; Maxwell equations in periodic structure; (3) computational fluid mechanics; (4) scattering of electromagnetic waves from complex objects; (5) magneto-optic recording media; the writing process; (6) semiconductors; (7) solid state physics and computational chemical physics; (8) problems in mathematical photography; (9) air quality modeling; (10) control theory; (11) imaging analysis; (12) micromagnetics; (13) near-infrared imaging; and (14) applied statistical information theory and data fusion. The following materials must be submitted: (1) personal statement of scientific interests, research plans, and reasons for wishing to participate in the program (this is an essential part of the application); (2) curriculum vitae and a list of publications. (3) three letters of recommendation, to be sent directly to the IMA. All material should arrive by January 13, 1995. All correspondence should be sent to: Industrial Mathematics Postdoctorate Membership Committee, Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church Street SE, Minneapolis, MN 55455-0436 U.S.A. The University of Minnesota is an Equal Opportunity educator and employer.

- **Los Alamos National Laboratory.** *Postdoctoral Appointments.* Research opportunities are granted in many areas of experimental and theoretical physics, chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Candidates must be recipients of a doctoral degree within the past three years. Appointments are available for two years, subject to renewal for a third year. Starting salary: \$39,660–\$41,770. A postdoctoral committee meets to review candidates for postdoctoral appointments in February, May, August, and December. Los Alamos National Laboratory is an Equal Opportunity Employer. For initial consideration, send résumé with publication listing to Mary Anne With, Mail Stop P-282, Los Alamos National Laboratory, Los Alamos, NM 87545.
- **Los Alamos National Laboratory.** *J. Robert Oppenheimer Research Fellowship.* Research opportunities are granted in many areas of experimental and theoretical physics, chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Candidates must be recipients of a doctoral degree within the past five years and must show clear and definite promise of becoming outstanding leaders in scientific research. Appointments are for two years, subject to renewal for a third year. Starting salary: \$62,460. Application deadline: mid-November each year. Los Alamos National Laboratory

is an Equal Opportunity Employer. For initial consideration, send résumé with publication listing to Mary Anne With, Mail Stop P-282, Los Alamos National Laboratory, Los Alamos, NM 87545.

Massachusetts Institute of Technology. *C. L. E. Moore Instructorships in Mathematics.* Offered by the Department of Mathematics at the Massachusetts Institute of Technology. Open to mathematicians with doctorates who show definite promise in research. The teaching load is six hours per week in one semester and three hours per week in the other. Appointments are for one year and are renewable for two additional years. Applicants please send (a) a vita, (b) a description of the research in your thesis and other work you have done (1–3 pages), and (c) the research which you plan for next year. Application should be sent, by December 31 if possible, to the Department of Mathematics, Room 2-263, Massachusetts Institute of Technology, Cambridge, MA 02139. M.I.T. is an Equal Opportunity Employer.

Mathematical Sciences Institute (MSI) at Cornell University. The MSI is beginning its search for postdoctoral visitors for the academic year beginning August 1994. The Institute supports research in the following areas: symbolic methods in algorithmic mathematics, stochastic analysis, the mathematics of nonlinear systems, and logic programming. For information about the Institute and about the research in algorithmic mathematics, logic programming, and stochastic analysis, please contact: MSI, 409 College Avenue, Ithaca, NY 14850; 607-255-8005. For information about research in nonlinear systems, please contact: J.G. Glimm, Dept. of Applied Mathematics and Statistics, SUNY Stony Brook, Stony Brook, NY 11794-3600; 516-632-8370. MSI prefers scientists who are not more than five years beyond the doctoral degree. Women and minority candidates are encouraged to apply. Candidates are eligible for academic-year appointments with possible extension to a second year. The salary is \$34,500 for nine months plus benefits. The deadline for 1995–1996 applications is January 3, 1995, and awards will be made March 15, 1995. In addition to a curriculum vitae, three letters of recommendation are required. One letter should come from the thesis advisor. Reprints of published articles are appreciated. MSI is partially funded by the U.S. Army Research Office. Cornell University is an Equal Opportunity, Affirmative Action Employer.

Mathematical Sciences Research Institute (MSRI). *Postdoctoral Fellowships.* The Institute will award about 20 year-long research fellowships with starting date September 1995 for new and recent Ph.D.s. The stipend will be at least \$30,000. The year 1995–1996 features a year-long program in Several Complex Variables, a fall program in Holomorphic Spaces, and a spring program in Convex Geometry and Geometric Functional Analysis; but some awards will be made in other areas, so applications from candidates in all fields are welcome. Application forms can be obtained by writing to the Mathematical Sciences Research Institute,

1000 Centennial Drive #5070, Berkeley, CA 94720-5070, or call 510-642-0143. Files must be complete by November 30, 1994. Please see page 553 of the May/June 1994 *Notices*.

The Michigan Society of Fellows. *Horace H. Rackham School of Graduate Studies, The University of Michigan.* The Michigan Society of Fellows was founded in 1970 through grants from the Ford Foundation and Horace H. Rackham Graduate School for the purpose of promoting academic and creative excellence in the arts, sciences, and professions. The objective of the program is to support individuals selected for outstanding achievement, professional promise, and interdisciplinary interests. We invite applications from qualified candidates for three-year postdoctoral fellowships at The University of Michigan. Candidates must have received the Ph.D. degree between January 1, 1992, and September 1, 1995. Fellows are appointed as assistant professors/postdoctoral scholars with departmental affiliations. They spend the equivalent of one academic year teaching; the balance of time is devoted to their own scholarly research and creative work. Applications will be screened by faculty in relevant University of Michigan departments. Final selections will be made by the Senior Fellows of the Society. Four new Fellows will be selected for three-year terms beginning September 1995. The initial stipend will be \$31,000. Completed applications are due October 12, 1994. Please send requests for application materials to Michigan Society of Fellows, 3030 Rackham Building, The University of Michigan, Ann Arbor, MI 48109-1070; 313-763-1259.

Michigan State University. *MSU Postdoctoral Instructorships.* Pending funding, several two-year positions will be available for new or recent Ph.D.s who show strong promise in research and teaching. These positions will begin in the fall of 1995, with a starting salary of at least \$34,000. The teaching load is at most four (3-credit) semester courses per year, and participation in the research activities of the department is expected. NSF postdoctoral fellowships or other awards may be held concurrently for a further reduction in teaching load. An applicant should send a vita as well as a brief statement of research interests and arrange to have sent three letters of recommendation commenting on the applicant's research and teaching abilities. All application materials should be addressed to The Hiring Committee, Department of Mathematics, Michigan State University, East Lansing, MI 48824-1027; email: hiring@math.msu.edu. The deadline for applications is December 1, 1994. MSU is an Affirmative Action/Equal Opportunity Institution.

National Center for Atmospheric Research. *Advanced Study Program.* Postdoctoral Fellowships are offered for highly qualified atmospheric scientists and scientists from related disciplines who wish to continue basic research in the atmospheric sciences. Appointments are for a one-year period with a possible extension for an additional year. The application deadline is January 7, 1995. Stipends are \$32,600 for recent recipients of the Ph.D. and are adjusted annually

in June. Inquiries should be sent to Barbara McDonald, Advanced Study Program, NCAR, P.O. Box 3000, Boulder, CO 80307-3000.

National Research Council. *Programs for Postdoctoral and Senior Research Associateships.* The National Research Council conducts the *Resident, Cooperative, and Postdoctoral Research Assistantship* programs on behalf of federal agencies or research institutions whose 120 participating research laboratories are located throughout the United States. The programs provide opportunities for Ph.D. scientists and engineers of unusual promise and ability to perform research on problems largely of their own choosing yet compatible with the research interests of the sponsoring laboratory. Approximately 350 new full-time Associateships will be awarded on a competitive basis in 1995 for research in: chemistry; earth and atmospheric sciences; engineering and applied sciences; biological, health, and behavioral sciences and biotechnology; mathematics; space and planetary sciences; and physics. Most of the programs are open to both U.S. and non-U.S. citizens and to both recent Ph.D. degree recipients and senior investigators. Awards are made for one or two years, renewable to a maximum of three years; senior applicants who have held the doctorate at least five years may request shorter periods. Annual stipends for recent Ph.D.s for the 1995 program year range from \$30,000 to \$45,500, depending upon the sponsoring laboratory, and will be appropriately higher for senior Associates. Financial support is provided for allowable relocation expenses and for limited professional travel during the duration of the award. The host laboratory provides the Associate with programmatic assistance including facilities, support services, necessary equipment, and travel necessary for the conduct of the approved research program. Applications submitted directly to the National Research Council are accepted on a continuous basis throughout the year. Those postmarked by January 15 will be reviewed in February, by April 15 in June, and by August 15 in October. Initial awards will be announced in March and April—July and November for the two later competitions—followed by awards to alternate candidates later. Information on specific research opportunities and participating federal laboratories, as well as application materials, may be obtained from: The Associateship Programs (TJ 2094/M), National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418; fax: 202-334-2759.

National Science Foundation. *Career Advancement Awards (CAA).* These awards are intended for women who already have established research careers and are seeking to dramatically forward their career in their current field or, more commonly, to change direction. Eligibility is limited to U.S. citizens, nationals, or permanent residents. Applicants may have had prior research support, federal or otherwise. Awards are limited to a maximum of \$50,000 for a period of 12 months, with an additional \$10,000 for equipment, if needed. Up to 10% of these funds may be used to defray administrative expenses in lieu of direct costs. These awards

are not renewable. Proposal deadline information is available from each program area. Ten copies of the proposal should be submitted to NSF disciplinary programs through standard institutional channels. For more information see the program announcement (NSF93-13) or write to: CAA Coordinator, National Science Foundation, Room 805, Arlington, VA 22230; 703-306-1603.

- National Science Foundation.** *CISE Postdoctoral Research Associates.* The Computer and Information Science and Engineering (CISE) Directorate of the National Science Foundation plans a limited number of grants of support of Postdoctoral Research Associateships contingent upon available funding. The Associates are of two types. Associateships in Computational Science and Engineering (CS&E Associates) are supported by the New Technologies Program in the Division of Advanced Scientific Computing (DASC) in cooperation with other NSF CS&E disciplines. The objective of these Associateships awards is to increase expertise in the development of innovative methods and software for applying high performance, scalable parallel computing systems in solving large scale CS&E problems. Associateships in Experimental Science (ES Associates) are supported by the Office of Cross Disciplinary Activities (CDA). The objective of the ES Associateship awards is to increase expertise in CISE experimental science by providing opportunities for associates to work in established laboratories performing experimental research in one or more of the research areas supported by the CISE Directorate. These awards provide opportunities for recent Ph.D.s to broaden their knowledge and experience and to prepare them for significant research careers on the frontiers of contemporary computational science and engineering and experimental science. It is assumed that CS&E Associates will conduct their research at academic research institutions or other centers or institutions which provide access, either on site or by network, to high-performance, scalable parallel computing systems and will be performing research associated with those systems. It is assumed that ES Associates will conduct their research in academic research institutions or other institutions devoted to experimental science in one or more of the research areas supported by the CISE Directorate. **Award Amounts, Stipends and Research Expense Allowances:** Awards will range from \$36,200–\$46,200 for a 24-month period. The award will include \$32,000–\$42,000 to support the Research Associate (to be matched equally by the sponsoring institution). There will also be an allowance of \$4,200 to the sponsoring institution, in lieu of indirect costs, as partial reimbursement for expenses incurred in support of the research. The annual award to the Research Associate will be composed of two parts: an annual stipend (salary and benefits) that may range from \$28,000–\$38,000 and a \$4,000 per year research expense allowance expendable at the Associate's discretion for travel, publication expenses, and other research-related costs. There is no allowance for dependents. The effective date of the award cannot be later than January 1996. For additional information, please contact Dr. Robert G. Voigt, Program Director, New Technologies, DASC, at

202-357-7727 (e-mail: rvoigt@nsf.gov) for CS&E Associates or Dr. John C. Cherniavsky, Head, CDA at 202-357-7349 (e-mail: jchernia@nsf.gov) for ES Associates.

- **National Science Foundation.** *Computer Science Research.* Grants support research concerned with such topics as theoretical foundations of computer science; software systems science; programming languages and compilers; software engineering; numeric, symbolic, and geometric computation; and computer systems, which includes graphics. Guidelines on eligibility and proposal preparation are available in "Grants for Scientific and Engineering Research". For this brochure and additional information write: Division of Computer and Computational Research, National Science Foundation, 1800 G Street, NW, Washington, DC 20550.

National Science Foundation. *Mathematical Sciences Postdoctoral Research Fellowships* (with Research Instructorship Option). The format of the 1995 Fellowship program has not been significantly changed from that of 1994. The stipend portion of the awards will consist of support for eighteen academic-year months or their equivalent and six summer months. Awardees have two options for academic year stipends, subject to the constraints that their academic-year support begin by October 1 of the award year and be configured in intervals no shorter than three consecutive months. An awardee may have full-time support for any eighteen academic-year months in a three-year period (the Research Fellowship Option) or have a combination of full-time and half-time support over a period of three academic years, usually as one academic year full-time and two academic years half-time (the Research Instructorship Option). Summer month stipends are limited to two per calendar year. Stipend amounts are \$2,750 per full-time month and \$1,375 per half-time month, for a total award of \$66,000 to be used within 48 months. Deadline for applications is October 15, 1994; awards will be announced on or about March 1, 1995. For further details write to the Mathematical Sciences Infrastructure Program, Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; call 703-306-1870; or send an inquiry to msprf@nsf.gov (Internet).

National Science Foundation. *Research Planning Grants for Women.* These awards are made to help increase the number of new women investigators participating in NSF's research programs and to assist those who have not previously developed a successful independent proposal for federally funded research to develop a more competitive NSF disciplinary research proposal. The grantee is expected to submit a full research proposal to NSF subsequent to the completion of the research planning grant. The grants are limited to \$18,000 up to 18 months. Up to 10% of these funds may be used to defray administrative expenses in lieu of direct costs. Eligibility is limited to women who have not served as principal or coprincipal investigators on independent federal research awards and to women who are U.S. citizens, nation-

als, or permanent residents. Proposal deadline information is available from each program area. Ten copies of the proposal should be submitted to NSF disciplinary programs through standard institutional channels. For more information see the program announcement (NSF 93-130) or write to: RPG Coordinator, Room 805, National Science Foundation, Arlington, VA 22230; 703-306-1603.

National Science Foundation. *Visiting Professorships for Women (VPW).* This program enables women scientists and engineers experienced in independent research to undertake advanced research at a university or research institution. In addition to research, the visiting professor undertakes lecturing, counseling, and other interactive activities. These may be done at the graduate or undergraduate level, be directed to the community at large, or involve some combination of such activities. Applicants must hold a doctorate (or have equivalent experience) in a field of research supported by NSF and have independent research experience. Candidates must be citizens or permanent residents of the U.S. The usual award is for twelve months for a full- or part-time professorship. Awards for one academic semester will also be considered, and the maximum award period is 15 months. The amount of the award will be determined by the work to be performed; past VPW awards have ranged from approximately \$30,000 to \$235,000. Proposals must be submitted by October 15 of each year. For more information contact the VPW Program Director at 703-306-1697 or write to obtain a Visiting Professorship Program announcement to: Program Director, Visiting Professorships for Women, Graduate Education and Research Development, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230.

Office of Naval Research (ONR) Postdoctoral Program. The ONR sponsors this program at a number of Naval R&D centers and laboratories. The program is designed to significantly increase the involvement of creative and highly trained scientists and engineers from academia and industry in scientific and technical areas of interest and relevance to the Navy. Scientific research and technological developments are pursued to address problems such as: hydrodynamics, aerodynamics, acoustics, electronic devices, biotechnology, oceanography, computer hardware and software, material science, target detection and surveillance, weaponry, directed energy, biomedicine, signal processing, simulation, training, construction, and logistics. The ONR Program provides approximately forty new postdoctoral appointments per year. Fellowship awards will be based upon the technical quality and relevance of the proposed research, recommendations by the Navy laboratories or centers, academic qualifications, reference reports, and availability of funds. Application deadlines are January 1, April 1, July 1, or October 1. Anyone interested must contact the research facility at which they are interested in working in order to develop a suitable research proposal. Proposals developed with the host facility stand the greatest chance of success in the selection process. The awards are for one year and are renewable for a second year,

given satisfactory performance and availability of funds. The stipend for the first year is \$36,000 (minimal experience). A travel and relocation allowance will be paid. To be eligible, participants must be citizens of the U.S. and have received their Ph.D., Sc.D., or equivalent within seven years of the date of application. For information write to ONR Postdoctoral Program, Projects Office, ASEE, Eleven Dupont Circle, Suite 200, Washington, DC 20036.

OTA Morris K. Udall Congressional Fellowship Program.

The Office of Technology Assessment is seeking qualified candidates from academia, private industry, and the public sector for its Congressional Fellowship Program. Up to six Fellows will be selected for a 1-year appointment in Washington, DC, beginning in September 1995. The program is open to men and women of all disciplines who have demonstrated exceptional competency in the physical or biological sciences, engineering, law, economics, environmental and social sciences, or public policy. Candidates must have completed research and training at the *doctoral level* or have equivalent experience. Salaries will range from \$35,000–\$70,000 per year, based on the Fellow's current salary and/or training and experience. In some instances a Fellow may accept a salary supplement from his or her parent institution. Applications and letters of reference must be received by January 31, 1995. For application information, contact Morris K. Udall Congressional Fellowship, Personnel Office, Office of Technology Assessment, 600 Pennsylvania Ave., SE, Washington, DC 20003; 202-224-8713.

President's Commission on White House Fellowships.

The White House Fellowships offer outstanding Americans early in their careers the opportunity to serve for one year, September through August, as special assistants to Cabinet officers, to the vice-president, or to members of the president's senior staff. The Fellowships are open to all U.S. citizens, with the exception of civilian employees of the federal government. Applications for the 1995–1996 Fellowships may be obtained from The President's Commission on White House Fellowships, 712 Jackson Place, NW, Washington, DC 20503; 202-395-4522. The application deadline is December 1, 1994.

Purdue University. *Research Assistant Professorship.* These positions are intended for recent Ph.D.s who can benefit from and contribute to an active research environment. Appointments are for the two academic years 1995–1997 and are nonrenewable. The teaching load is two courses per semester. Advanced courses are encouraged; the department presently has 150 graduate students. Candidates are expected to have a Ph.D. degree in mathematics prior to September 1995. Selection will be based primarily on outstanding research potential in an area where some interaction with present faculty seems likely. Applicants should mention at least one Purdue faculty member with whom they expect to have interests in common. Applications, including a vita; brief description of research interests; and three letters of recommendation, one

of which addresses teaching, should be sent to Leonard Lipshitz, Head, Department of Mathematics, Purdue University, West Lafayette, IN 47907-1395. Preference will be given to completed applications received by December 15, 1994. Purdue University is an Equal Opportunity/Affirmative Action Employer.

Rice University. *Griffith Conrad Evans Instructorships.* Postdoctoral appointments for two to three years for promising research mathematicians with research interests in common with the active research areas at Rice. Applications received by December 31, 1994, will receive thorough consideration. Rice University encourages applications from women and minority group members. Inquiries and applications should be addressed to Chairman, Evans Committee, Department of Mathematics, Rice University, Box 1892, Houston, TX 77251.

Rutgers, The State University of New Jersey. Department of Mathematics, New Brunswick, NJ, anticipates the following open positions beginning September 1995, pending administrative approval. *Hill Assistant Professorships.* These are three-year nonrenewable positions. Candidates should have recently received the Ph.D., show outstanding promise in research ability in pure or applied mathematics, and have concern for teaching. Normal course load approximately six hours per semester but one course teaching reduction provided in two of the three years, resources permitting. Send résumé and at least three letters of recommendation to Search Committee, Department of Mathematics, Rutgers University, New Brunswick, NJ 08903 by January 2, 1995. 1994 applicants may call or write to have applications reactivated. Indicate position desired and give # of your area of specialty according to AMS Mathematics Subject Classification. Applications with e-mail addresses will be acknowledged. Rutgers University is an Equal Opportunity/Affirmative Action Employer.

- **Sigma Delta Epsilon, Graduate Women in Science.** See the listing in the Graduate Support section for information.

Sloan Foundation. *Research Fellowships.* Unrestricted grants made to selected university scientists in the physical sciences, mathematics, applied mathematics, computer science, economics, and neuroscience. Candidates must be members of the regular faculty, though not necessarily in a tenured position, at a recognized college or university in the United States or Canada. Candidates do not apply but are nominated by their department chairmen or other scientists. Nominations are due by September 15 for awards to begin the following September. For information write to the Sloan Research Fellowships, Alfred P. Sloan Foundation, 630 Fifth Avenue, New York, NY 10111.

The U.S. Arms Control and Disarmament Agency (ACDA). *William C. Foster Fellows Visiting Scholars Program.* The purpose of the program is to give specialists in the physical sciences and other disciplines relevant to the Agency's activi-

ties an opportunity for active participation in the arms control and disarmament activities of the Agency and to gain for the Agency perspective and expertise such persons can offer. Positions are available in the Bureau of Strategic and Eurasian Affairs (SEA); the Bureau of Multilateral Affairs (MA); the Bureau of Intelligence, Verification and Informational Support (IVI); and the Bureau of Nonproliferation and Regional Arms Control (NP). Evaluation of applicants for appointments to these positions will focus upon the scholar's potential for providing expertise or performing services needed by ACDA, rather than on the scholar's previously displayed interest in arms control. While pursuit of the scholar's own line of research may sometimes be possible, support of such activity is not the purpose of the program. One-year assignments will begin at a mutually agreeable time after successful completion of all employment requirements. Visiting scholars will be detailed to ACDA by their universities; the universities will be compensated for the scholar's salary and benefits in accordance with the Intergovernmental Personnel Act and within Agency limitations. Visiting scholars will also receive reimbursement for travel to and from the Washington, DC, area for their one-year assignment or relocation costs. Visiting scholars must be citizens of the United States, on the faculty of a recognized institution of higher learning, and tenured or on a tenure track or equivalent; they must also have served as a permanent career employee of the institution for at least ninety days before selection for the program. ACDA is an Equal Opportunity Employer. Selections will be made without regard to race, color, religion, sex, national origin, age, or physical handicap that does not interfere with performance of duties. Prior to appointment, applicants will be subject to a full-field background security investigation for a Top Secret security clearance, as required by Section 45 of the Arms Control and Disarmament Act. Candidates will not be extended a formal offer of appointment until a security clearance has been granted and all other requirements have been met. This procedure can take from six to nine months. Visiting scholars will also be subject to applicable federal conflict of interest laws and standards of conduct. To apply, submit a letter indicating the positions interested in and the perspective and expertise offered. Include in the letter a curriculum vitae and any other materials, such as letters of reference and samples of published articles (no more than two), that should be considered in the selection process. Submit twelve copies of each article. Send applications and any requests for additional information to: Visiting Scholars Program, Operations Analysis and Information Management Office, Room 5726, U.S. Arms Control and Disarmament Agency, Washington, DC 20451. The applications deadline for the 1995-1996 academic year is January 31, 1995, subject to extension at ACDA's option. ACDA expects to announce tentative selections in the spring of 1995.

U.S. Department of Energy (DOE). *Special University-Laboratory Cooperation.* Participants engage in laboratory-approved projects in a program designed to increase the interactions and flow of information between universities and

DOE laboratories. Included is research in applied mathematics and computer science. Inquiries should be addressed to the director at any of the following organizations: Associated Western Universities, 4190 South Highland Drive, Suite 211, Salt Lake City, UT 84124; Argonne Division of Educational Programs, 9700 South Cass Avenue, Argonne, IL 60439; Brookhaven National Laboratory, Upton, NY 11973; Northwest College and University Association for Science (NORCUS), 390 Hanford St., Richland, WA 99352-1620; Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, TN 37831-0117.

U.S. Department of Health and Human Services, National Institutes of Health, supports postdoctoral training in specified areas of biomedical and behavioral research. Applicant must have earned an appropriate degree and arranged for appointment to an institution and acceptance by a sponsor who will supervise the training research experience. U.S. citizenship or lawful admittance to the U.S. for permanent residence is required. Announcements and application kits available from the Grants Information Office, Division of Research Grants, National Institutes of Health, Bethesda, MD 20892. An enclosed self-addressed gummed mailing label will expedite handling.

- **University of California.** *President's Postdoctoral Fellowship Program.* The University of California offers postdoctoral fellowships to enhance the competitiveness of outstanding minority and women scholars for academic appointments at major research universities such as the University of California. Awards are for one academic year with the possibility of renewal for a second year pending demonstration of satisfactory progress. Stipends start at \$26,000 plus health benefits and up to \$4,000 for research expenses. Applicants must be U.S. citizens or permanent residents and hold a Ph.D. degree from an accredited university. Preference is given to minority and women candidates historically underrepresented in higher education. Applications are encouraged from African Americans, American Indians, Asian Americans, Filipinos, Mexican Americans and Latinos, and from white women in physical sciences, mathematics and engineering. Further information and application materials may be obtained from: University of California, 300 Lakeside Drive, 18th Floor, Oakland, CA 94612-3550; 510-987-9500. Application and information materials will be available in the fall. The application deadline is December 14, 1994. An Equal Opportunity, Affirmative Action Employer.
- **University of California, Los Angeles.** *Biostatistical Training in AIDS.* See listing in the Graduate Support section for more information.

University of California, Los Angeles. *Earle Raymond Hedrick Assistant Professorships in Mathematics.* The Department of Mathematics, University of California, Los Angeles, announces the availability of two appointments for the year 1995-1996, subject to administrative approval. These

awards will be made to mathematicians with recent Ph.D.s who show strong promise in research. The appointments will be for three years at an annual salary of \$39,600 in the first year. The teaching load will be three hours per week for two quarters and six hours per week for one quarter. Requests for application forms should be sent by electronic mail to search@math.ucla.edu or in writing to John B. Garnett, Chair, Department of Mathematics, University of California, 405 Hilgard Avenue, Los Angeles, CA 90024-1555, Attn: Staff Search. Preference will be given to applications completed by January 1, 1995. UCLA is an Equal Opportunity/Affirmative Action Employer.

University of California, San Diego. *S. E. Warschawski Assistant Professorship.* The S. E. Warschawski Assistant Professorship is a special two-year position. The nine-month salary is \$40,000. Candidates (of any age) should possess a recent Ph.D. degree (received no earlier than 1992) in mathematics or expect to receive one prior to July 1995. All areas of specialization will be considered. Selection will be based primarily on demonstrated research achievement. Teaching experience is desirable. To apply, please submit your placement file, including vita and publications, and arrange for three letters of reference to be sent to the Faculty Search Committee; Department of Mathematics, 0112; University of California, San Diego; 9500 Gilman Dr., La Jolla, CA 92093-0112. Please indicate primary research area (field and #) using the Mathematics Subject Classification as listed in the *Mathematical Reviews Annual Subject Index*. All applications received by January 2, 1995, will receive thorough consideration. All supporting material must be received no later than January 9, 1995. In compliance with the Immigration Reform and Control Act of 1986, individuals offered employment by the University of California will be required to show documentation to prove identity and authorization to work in the United States before hiring can occur. UCSD is an Equal Opportunity/Affirmative Action Employer.

University of Chicago. *Assistant Professorships and Leonard Eugene Dickson Instructorships in Mathematics.* The Dickson Instructorships are intended for new or recent Ph.D.s. Appointment is for two years, with a possible third year renewal; annual salary is at least \$40,000. The Assistant Professorships are intended for persons with two or more years of postdoctoral experience. Appointment is for three years, salary is competitive. All application materials should be received by January 1, 1995. Further information and application forms may be obtained from the Appointments Secretary, Department of Mathematics, University of Chicago, 5734 S. University Avenue, Chicago, IL 60637.

University of Michigan, Ann Arbor. *Assistant Professorships and T. H. Hildebrandt Research Assistant Professorships.* Designed to provide mathematicians with favorable circumstances for the development of their research talents. Preference is given to persons of any age having their Ph.D.

less than two years. The teaching load is two courses per term for Assistant Professorships and one and one-half courses per term for the Hildebrandt Professorships. The stipend for the academic year 1995–1996 will be competitive and determined later; there is a good possibility of additional income during the summer. Appointments are for three years. NSF postdoctoral fellowships may be held simultaneously providing a reduction in teaching load. Applicants should submit completed application form and request at least three letters of recommendation. Letters should contain comments on applicant's mathematical promise, teaching ability, and personality. Applications should be accompanied by a research plan; three letters of recommendation, including one that specifically addresses teaching experience and capability; a description of teaching experience; and an indication of senior faculty at Michigan with whom they have a common research interest and who might mentor them. First preference will be given to applications completed and supported by three or more letters prior to January 4. Applications should be made to B. A. Taylor, Chairman, Department of Mathematics, University of Michigan, Ann Arbor, MI 48109-1003. Affirmative Action Employer.

University of Minnesota-Minneapolis. *Dunham Jackson Instructorship.* This is a three-year appointment from fall 1995 to spring 1998 with a teaching load of one course per quarter. Outstanding research and teaching abilities required. Preference will be given to candidates whose research interests are compatible with those of the school. Candidates should have received a Ph.D. or equivalent degree in mathematics no earlier than January 1, 1994, and no later than September 15, 1995. Summer school teaching may be available during summer of 1996 and 1997 to supplement regular stipend. Salary competitive. Consideration of applications will begin December 1, 1994. Contact Eugene Fabes, Head, School of Mathematics, University of Minnesota, 206 Church Street, SE, 127 Vincent Hall, Minneapolis, MN 55455. The University of Minnesota is an Equal Opportunity Educator and Employer.

University of Pennsylvania. *Hans Rademacher Instructorship.* This postdoctoral position has been instituted in the Mathematics Department in honor of Hans Rademacher, a member of the department from 1934 to 1962. Appointment will be for two years, beginning July 1, 1995. Applicants should have received a Ph.D. in mathematics before start of the appointment, but no earlier than 1993, and are expected to show promise of significant accomplishment. The position carries a reduced academic-year teaching load. Salary will be at least \$36,000 and there is an additional discretionary research fund of \$1,500. A letter of application, vita and publications, and three letters of recommendation should be received by December 15, 1994. Write to: Personnel Committee, Department of Mathematics, University of Pennsylvania, Philadelphia, PA 19104-6395. The University of Pennsylvania is an Equal Opportunity/Affirmative Action Employer.

University of Pittsburgh. *African American Postdoctoral Fellowships.* These Fellowships are intended to foster the professional development of recent African American recipients of doctoral degrees. Although applicants from all academic disciplines may apply, priority consideration will be given to applicants in those fields where African Americans are most underrepresented and in fields for which postdoctoral external funding opportunities are limited. Fellowships are awarded on an annual basis. The fellowship stipend is \$27,000 for the fall and spring terms plus \$2,500 for travel and related research costs. Fellows are expected to be in residence for the duration of their appointment; to engage in advanced study, research, and writing; and to teach one course for one term. Fellows are eligible for a maximum of two years of fellowship support. Preference is given to applicants a) whose research projects are relevant to the interests and expertise of specific faculty at the University of Pittsburgh, b) in academic areas where African American faculty are most underrepresented, c) from academic units where new faculty are likely to be hired. Applicants are expected to have successfully completed all doctoral degree requirements prior to September 1 of the fellowship year. The departments in arts and sciences follow: natural sciences: behavioral neuroscience, biological sciences, chemistry, computer science, crystallography, geology & planetary science, intelligent systems studies, mathematics and statistics, physics, psychology; approximately five fellowships are to be awarded. Supporting materials include: (1) a cover letter indicating the department of interest in arts and sciences; (2) a two- or three-page abstract of the applicant's dissertation; (3) a five- to ten-page proposal which discusses the research project, a timetable for its completion, and a description of the human resources, research materials, facilities to be used; (4) a certified graduate transcript; (5) a curriculum vitae; and (6) three letters of recommendation that address the applicant's qualifications for postdoctoral study. Deadline for receipt of application and all supporting material is April 15, 1995. Write to: African American Postdoctoral Fellowships, Office of the Dean of Graduate Studies, Faculty of Arts and Sciences, 910 Cathedral of Learning, University of Pittsburgh, Pittsburgh, PA 15260; 412-624-6094; fax: 412-624-5299.

- **University of Texas at Austin.** *R H Bing Faculty Fellowships.* Two fellowships will be available at the University of Texas at Austin with terms beginning September 1, 1995. Each Fellow will hold an instructorship in the Mathematics Department, with a teaching load of two courses in one semester and one course in the other. The beginning salary will be \$36,000 with a travel supplement of \$1,000 per year. The fellowships are not renewable after three years. Applicants must show outstanding promise in research, and in general preference will be given to those having doctorates conferred in 1994 or 1995. There are no restrictions on applicants' fields of interest. To apply, send a vita and have three letters of recommendation submitted by January 1, 1995, to R. H. Bing Faculty Fellowships, Department of Mathematics, The University of Texas, Austin, TX 78712. The University of

Texas is an Equal Opportunity Employer. Qualified women and minority group members are urged to apply.

University of Utah. *Instructorship in Mathematics.* Two or more nonrenewable three-year instructorships are offered. Persons of any age receiving Ph.D. degrees in 1994 or 1995 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be \$36,500; future cost of living increases are contingent on action by the state legislature. Duties consist of teaching five courses during the three-quarter academic year. *C.R. Wylie Instructorship.* The term of this instructorship is one year, but it may be renewed for up to three years. It will be awarded either to an incoming instructor or to one of the instructors already in residence on the basis of ability and potential in teaching and research. The stipend is \$40,500. Duties consist of teaching four courses during the three-quarter academic year. Please send application to Instructorship Committee, Department of Mathematics, University of Utah, Salt Lake City, UT 84112. Offers are expected to be made beginning January 1, 1995, but applications will continue to be accepted until all positions are filled. The University of Utah is an Equal Opportunity/Affirmative Action Employer and encourages nominations and applications from women and minorities and provides reasonable accommodation to the known disabilities of applicants and employees.

Yale University. *Josiah Willard Gibbs Instructorships/Assistant Professorships.* Offered to men and women with the doctorate who show definite promise in research in pure mathematics. Applications from women and members of minority groups are welcome. Appointments are for two/three years. The 1994-1995 salary is \$39,500. The teaching load is kept light to allow ample time for research. This will consist of three one-semester courses. Part of the teaching duties over the term of the appointment may consist of a one-semester course at the graduate level in the general area of the instructor's research. Inquiries and applications should be addressed to the Gibbs Committee, Department of Mathematics, Yale University, Box 2155 Yale Station, New Haven, CT 06520. Deadline for applications and supporting materials is January 1, 1995.

Travel and Study Abroad

The African-American Institute. Seeks to further African development and to strengthen understanding between the United States and Africa. For information about the several programs write the African-American Institute program representatives in twenty-two African countries, relevant African ministries or universities, or the Division of Education, African-American Institute, 833 United Nations Plaza, New York, NY 10017.

American-Scandinavian Foundation. Grants and Fellowships for study or research in Scandinavia (Denmark, Finland,

Iceland, Norway, and Sweden). Applicants must be U.S. citizens or permanent residents and have completed their undergraduate education by the time the overseas project is to begin. Necessary language competence, financial need, and merit in pursuing the study program in Scandinavia are considered in making these awards. The deadline for completed applications is November 1. Write to the Exchange Division, The American-Scandinavian Foundation, 725 Park Avenue, New York, NY 10021.

Centro de Investigación y de Estudios Avanzados del IPN. *Solomon Lefschetz Research Instructorships.* Offered to young mathematicians with doctorates who show definite promise in research. Appointments are for one year with a possibility of renewal for another year. Salary equivalent to that of assistant professor in the mathematics department. An allowance for moving expenses. The principal duties will be to do research and to teach a graduate course in the area of your specialty. Knowledge of Spanish is desirable. Deadline for applications is February 28, but late applications may be considered. Inquiries should be addressed to: Solomon Lefschetz Instructorships, Mathematics Department, CINVESTAV del IPN, Apartado Postal 14-740, 07000, México, D.F., México; Phone (52-5) 754-4466; Telex 017-72826 PPTME; Fax (52-5) 752-64-12.

Winston Churchill Foundation. A scholarship program for graduate work in engineering, mathematics, and science at Churchill College, Cambridge University. Tuition and living allowance worth approximately \$20,000. Application forms are available from representatives on campuses of colleges and universities participating in the program. For further information write to The Winston Churchill Foundation, P.O. Box 1240, Gracie Station, New York, NY 10028.

Lady Davis Fellowship Trust. Fellowships for study and/or research at graduate or postdoctoral levels at the Hebrew University of Jerusalem and the Technion-Israel Institute of Technology, Haifa. Lady Davis Fellows will be selected on the basis of demonstrated excellence in their studies; promise of distinction in their chosen fields of specialization; and qualities of mind, intellect, and character. The Fellowships are tenable for a period of one year. They may be renewed for a second year and in special circumstances extended for a third year. They are intended to defray travel and tuition fees and to meet reasonable living expenses. Only students who are enrolled in a Ph.D. program overseas are eligible applicants for the Fellowship at the Hebrew University. Applicants for the Technion must have completed their studies with excellent marks. Postdoctoral candidates may apply not later than 3 years after completion of their doctoral dissertation. Deadline for completed applications is December 1, 1994. Application forms can be obtained from the Lady Davis Fellowship Trust, P.O. Box 1255, Jerusalem, Israel.

Lady Davis Visiting Professorships. Lady Davis Visiting Professorships, for periods from one semester to a full

academic year, are intended for candidates with the rank of full or associate professor at their own institution. Such Visiting Professors are appointed after consultation with the appropriate faculties of the Hebrew University of Jerusalem or the Technion-Israel Institute of Technology, Haifa. The grant includes a professorial salary and cost of travel. Deadline for completed applications is December 1, 1994. Application forms can be obtained from the Lady Davis Fellowship Trust, P.O. Box 1255, Jerusalem, Israel.

- **Fulbright-Hays Program.** *Fulbright and Other Grants for Graduate Study Abroad.* For graduate study or research in any field in which the project can be profitably undertaken abroad. Applicant must be a U.S. citizen, hold a B.A. degree or the equivalent, and have language proficiency sufficient to carry out the proposed study and to communicate with the host country. If an applicant is already enrolled in a U.S. university, he must apply directly to the Fulbright Program Adviser on his campus. Unenrolled students may apply to the Institute of International Education. Further details may be obtained from the U.S. Student Programs Division, Institute of International Education, 809 United Nations Plaza, New York, NY 10017, 212-984-5330.

Fulbright Teacher Exchange Program. Sponsored by the United States Information Agency, this program offers international exchange opportunities for college/university faculty members and elementary and secondary school teachers and administrators. Eligibility requirements are U.S. citizenship, fluency in English, a bachelor's degree or higher, three years full-time teaching/administrative experience, and a current full-time teaching/administrative position. In addition to the general eligibility requirements, each applicant must meet the specific subject, level, and language fluency requirements for the countries to which he/she applies; these requirements are detailed in the application booklet. Currently the program conducts exchanges with thirty-four countries in eastern and western Europe, Latin America, and Africa. (The list of countries is subject to change.) Most exchanges are for the full academic year; however, some are for a semester or six weeks. A few one-way assignments are also available. In most cases, both the U.S. and international teacher remain on the payroll of their respective home institutions. Grants to teach abroad may include round-trip transportation for the participant (except Canada, Switzerland, and the United Kingdom). The Fulbright Teacher Exchange Program also offers an eight-week summer seminar in Italy, which is open to college and university faculty and teachers (grades 9-12) of Latin, Greek, and the classics. The application deadline is October 15 for the following year's program. The application booklet should be requested from the Fulbright Teacher Exchange Program, 600 Maryland Ave., SW, Room 235, Washington, DC 20024; 800-726-0479; ATTN: JBL.

Alexander von Humboldt Foundation. *Research Fellowships.* Up to 500 research fellowships are awarded annually to highly qualified foreign scholars holding doctorates and

under the age of forty. The fellowship allows the recipient to carry out research work in the Federal Republic of Germany for a period of 6–12 months. All disciplines, all nationalities, no quotas. Applications may be submitted at any time; however, the actual selection committees meet in March, July, and November. Monthly stipends range from DM 3,200 to DM 4,000 net. Family allowances, travel expenses, and language courses are covered by the fellowship. Application requirements include high academic qualifications, academic publications, a specific research plan, and, for humanities scholars, a good command of the German language. Applications may be obtained from the Alexander von Humboldt Foundation, 1350 Connecticut Ave., Suite 903, NW, Washington, DC 20036.

Alexander von Humboldt Foundation. *Research Awards.* Provides prominent scholars in the natural sciences with the opportunity to carry out research at a university or other research institute within the Federal Republic of Germany. Nominations for awards must be made by eminent German scholars; direct applications are not accepted. There is no age limit; however, scholars must have a position as a full/associate professor and an internationally recognized research record. Award winners are invited to spend a research stay of 4–12 months in Germany. Nominators may contact the Alexander von Humboldt Foundation, Jean-Paul-Str. 12, D-5373 Bonn, Federal Republic of Germany.

International Research and Exchanges Board (IREX). IREX administers academic exchange programs, open to advanced graduate students, postdoctoral scholars, and faculty members in all fields of study who are United States citizens and who are affiliated with a North American college or university. Exchange agreements are in effect with Central and Eastern Europe, the states of the former Soviet region, and Mongolia. Placements are made for one to ten months at universities or academy institutes. For more detailed information, write to the International Research & Exchanges Board, 1616 H Street, NW, Washington, DC 20006; 202-628-8188; fax: 202-628-8189.

Italian National Research Council Fellowships. The Italian National Research Council (*Consiglio Nazionale delle Ricerche*) will offer in 1995 some fellowships for foreign mathematicians. The stipend is 2,200,000 Italian lire per month, for a maximum of twelve months, plus travel expenses to and from the country of residence. Prospective applicants may write for details to: Prof. Carlo M. Scoppola, C.N.R., via Santa Marta 13A, 50139 Firenze, Italy. A copy of the application form will be sent when the scholarships are officially announced.

- **Kosciuszko Foundation.** *Graduate and Postgraduate Exchange with Poland.* Open to U.S. graduate students who have a knowledge of the Polish language. Students receive tuition, housing, and a monthly stipend for living expenses. Transportation to and from Poland is at the expense of the par-

icipant. Apply by January 15 for the following academic year. Write to Kosciuszko Foundation, Domestic Grants Office, 15 East 65th Street, New York, NY 10021.

Marshall Scholarships. Up to forty scholarships are offered by the British Government to U.S. graduates; tenable at any university in the United Kingdom. Recipients of awards are required to take a degree at their British university. Fields unrestricted. Deadline: October 17, to commence the following September; age limit: 25 years. Apply through British Consulates-General in the following regions (1) Northeast: Federal Reserve Plaza, 600 Atlantic Avenue, 25th Floor, Boston, MA 02210; (2) Mideast: British Embassy Cultural Dept., 3100 Massachusetts Avenue, NW, Washington, DC 20008; (3) South: Marquis One Tower, 245 Peachtree Center Avenue, Suite 2700, Atlanta, GA 30303; (4) Midwest: 33 North Dearborn Street, Chicago, IL 60602; (5) Pacific: 1 Sansome Street, San Francisco, CA 94104.

National Academy of Sciences (NAS). *Individual Exchange and Project Development Visits.* The NAS invites applications from American scientists who wish to make visits to or to host foreign scientists from Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kirghizia, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. The program of individual exchanges will support 1- to 6-month research visits during calendar year 1996. The program of two-week project development visits will support two cycles of visits: January through June 1996 and July through December 1996. Applicants for the project development visits need to demonstrate that a joint proposal for collaborative research will be prepared during their visit for submission to the National Science Foundation for funding. There is special emphasis on young investigators in each program. Applicants must be U.S. citizens and have doctoral degrees or their equivalent in physics; chemistry; mathematics and computer sciences; earth, atmospheric, and oceanographic sciences; biological sciences; environmental sciences; engineering; archaeology and anthropology; geography; psychology; science and technology policy; or the history and philosophy of science six months prior to the requested beginning date of their visit. Projects in the economic and social sciences that involve development of new analytical methodologies will be considered on a case-by-case basis. Requests for applications for the first round of the project development visits must be postmarked no later than June 24, 1995. Applications for long-term individual exchanges (1–6 months) to travel or host in 1996 must be postmarked by June 24, 1995. Applications for the second round must be postmarked by December 9, 1995. Address application requests to: Office for Central Europe and Eurasia, National Academy of Sciences, 2101 Constitution Ave., NW, Washington, DC 20418.

- **National Science Foundation.** Travel awards for U.S. citizens (or permanent resident aliens) who are either predoctoral

students or individuals who have held a doctoral degree for three years or less as of the starting date of the Institute to attend North Atlantic Treaty Organization (NATO) Advanced Study Institutes in Europe. Applications are made to the appropriate NATO Institute director who nominates eligible candidates. Information may be obtained by writing to the Advanced Institute Travel Awards Program, Division of Graduate Education and Research Development, National Science Foundation, Washington, DC 20550; 202-357-7536.

Natural Sciences and Engineering Research Council of Canada. *Visiting Fellowships.* The Government of Canada offers Fellowships on behalf of the following Canadian Government departments and agencies: Agriculture and Agri-Food Canada, Canadian Space Agency, Industry Canada, National Defence, Natural Resources Canada, Environment Canada, Fisheries and Oceans, Canadian Forest Service, Health Canada, National Research Council Canada, Public Service Commission, AECL Research, Canadian Museum of Nature. The annual value of the fellowships is \$35,184 effective October 1, 1994, subject to Canadian income tax. The initial appointment is for one year, with a possibility of renewal for a second year. The applicant should hold a recent doctoral degree (within the last five years). The closing date for applications is November 15 each year. Write to the Visiting Fellowships Office, Natural Sciences and Engineering Research Council of Canada, 350 Albert Street, Ottawa, Ontario, Canada K1A 1H5.

- **North Atlantic Treaty Organization.** The NATO Science Committee has a Programme of Grants for Collaborative Research which provides financial aid for research projects aimed at stimulating, encouraging, and facilitating scientific research in collaboration between scientists working in different member countries of the alliance, thus promoting the flow of ideas and of experimental and theoretical methods across frontiers. Projects are supported for a limited period, usually not exceeding five years, covering mainly travel and living expenses abroad for principal investigators visiting partner laboratories or for staff members collaborating on specific projects with laboratories abroad. Deadlines for applications are 31 March, 15 August, and 30 November. Application forms and details of the awards together with information about the Science Committee's other programmes can be obtained from: Scientific Affairs Division, NATO, B-1110 Brussels, Belgium.

- **North Atlantic Treaty Organization.** *Postdoctoral Fellowships in Science and Engineering.* Awarded for a tenure of 6 to 12 months for scientific study or work at appropriate nonprofit institutions in NATO countries other than the U.S. This program is for citizens or nationals of the U.S. or permanent resident aliens of the United States at time of application. Fellows receive a stipend of \$33,000 for twelve-month tenure, plus dependency and travel allowances. Application deadline is approximately November 6, 1994. Applications will be available in late August 1994. For information and

application material, write to NATO Program, Division of Graduate Education and Research Development, National Science Foundation, Washington, DC 20550.

- **Social Sciences Research Council.** *International Dissertation Research Fellowship Program.* The program provides support to advanced doctoral candidates at U.S. universities for dissertation research in Africa, China, Eastern Europe, Japan, Korea, Latin America and the Caribbean, the Near and Middle East, South and Southeast Asia, the former Soviet Union and its successor states, and Western Europe. Full information on this program may be obtained by writing to the Social Science Research Council, Fellowships and Grants, 605 Third Avenue, New York, NY 10158; 212-661-0280.

Weizmann Institute of Science. *Feinberg Graduate School Postdoctoral Fellowships.* The Fellowships are intended mainly for scientists who have recently obtained their Ph.D. degree. The Fellowships provide a 12-month stipend (with possible renewal for a second year), a small relocation allowance, and a one-way air ticket. Round-trip airfare is provided if the Fellowship is extended for a second year. The annual stipend is adjusted periodically in accordance with living costs. Application forms and additional information may be obtained from the Feinberg Graduate School, The Weizmann Institute of Science, P.O. Box 26, Rehovot 76100, Israel. The review of applications is held twice a year, on January 1 and May 15.

Weizmann Institute of Science. *Openings for Scientists.* The Weizmann Institute of Science is now offering a limited number of temporary appointments to the position of scientist. Candidates must have completed two years of post-doctoral work. Appointments will be made in all the areas of scientific research at the Institute: biology, chemistry, biochemistry-biophysics, physics, mathematics, and science teaching. Appointments are for a period of one year; however, they may be extended for a period not to exceed five years from receipt of Ph.D. degree (or equivalent). Successful appointees will be eligible to apply for promotion to the position of senior scientist. Financial remuneration for a scientist is at the level of lecturer and includes all of the associated benefits. In addition, a relocation stipend is provided. Applications and additional information may be obtained from The Feinberg Graduate School, The Weizmann Institute of Science, Rehovot, 76100 Israel. Applications are reviewed each year on January 1 and May 15.

Study in the U.S. for Foreign Nationals

Many of the programs in the Graduate Support and Postgraduate Support sections are also applicable to foreign nationals.

American-Scandinavian Foundation. Scandinavian scholars are awarded graduate fellowships to study in the U.S.

For information write to the appropriate society in Scandinavia cooperating with The American-Scandinavian Foundation (Danmark-Amerika Fondet, Dronningens Tvaergade 44, DK-1302, Copenhagen K, Denmark; Suomi-Amerikka Yhdistysten Liitto, Mechelininkatu 10, SF-001 00 Helsinki, Finland; Íslenzk-ameríska félagid, Box 370, 121 Reykavík, Iceland; Norge-Amerika Foreningen, Drammensveien 20C, 0255 Oslo 2, Norway; Sverige-Amerika Stiftelsen, Box 5280, S-102 46 Stockholm, Sweden) or to the Exchange Division, The American-Scandinavian Foundation, 725 Park Avenue, New York, NY 10021.

American Association of University Women (AAUW) Educational Foundation. *International Fellowships.* These are awarded to women of outstanding academic ability who are not citizens or permanent residents of the U.S. for full-time graduate or postgraduate study in the U.S. Applicants must hold the equivalent of a U.S. bachelor's degree by December 1. Upon completion of studies, fellowship recipients must return to their home countries to pursue professional careers. Previous and current recipients of AAUW fellowships are not eligible. The fellowships provide \$15,065 each. The deadline is December 1. For more information, contact: AAUW Educational Foundation, P.O. Box 4030, Iowa City, IA 52243-4030; telephone: 319-337-1716; fax: 319-337-1204.

- **Fulbright Program.** Grants under the Fulbright Act for study, research, teaching, and lecturing in the United States are available to nationals of many countries. Information regarding these opportunities may be secured from the Cultural Affairs Officer of the United States Embassy or from the Binational Educational Commission or Foundation, if there is one in the inquirer's own country. The number of grants for each academic year will depend on funds available.
- **Institute of International Education.** Grants for study, training, and research in the U.S. Open to nationals of most countries. IIE develops and administers exchange programs for a number of organizations and corporations and administers U.S. Government grants under the Fulbright and other educational exchange programs of the U.S. Information Agency. Information regarding these opportunities may be secured from the Cultural Affairs Officer of the U.S. Embassy or from the Binational Commission or Foundation, if there is one in the inquirer's own country.

Kennedy Scholarships. For citizens of the United Kingdom, these grants are for postgraduate study at Harvard University or the Massachusetts Institute of Technology. Application deadline is October 28. Write to Secretary, Kennedy Memorial Trust, 16 Great College Street, London SW1P 3RX, England.

Kosciuszko Foundation. One-year grants to doctoral and postdoctoral students. Applicants must be Polish citizens and have excellent command of English. The Foundation provides a cost-of-living stipend, which includes housing; accident insurance; incidental costs of books; copying charges; and,

when warranted, transatlantic and domestic transportation. Apply by October 15 for the following academic year. Write to Scholarship and Exchange Programs, the Kosciuszko Foundation, 15 East 65th Street, New York, NY 10021.

Sources of Fellowship Information

Some of the publications listed below are available at school or college and university libraries, or in the reference room of a good public library.

Academic Year Abroad. Sara Steen (ed.). Describes over 2,100 study-abroad programs, both undergraduate and graduate, conducted during the academic year in countries around the world. Information on courses, costs, credits, housing, scholarships, and language of instruction. 1994/1995. Annual. \$42.95 (plus \$4.00 postage and handling). IIE Books, Institute of International Education, 809 United Nations Plaza, New York, NY 10017.

American Association of University Women Educational Foundation. American Fellowships, Eleanor Roosevelt Teacher Fellowships, Selected Profession Fellowships, and Career Development Grants. For more information, write or call AAUW Educational Foundation, P.O. Box 4030, Iowa City, IA 52243-4030; 319-337-1716.

Annual Register of Grant Support, 1995. R.R. Bowker, A Reed Reference Publishing Company, 121 Chanlon Rd., New Providence, NJ 07974. Directory of fellowships; grant support programs of government agencies, foundations, corporations, and business and professional organizations. Annual. \$185.00 plus \$12.95 postage and handling.

Basic Facts on Foreign Study. A fact sheet on what to expect from a study-abroad program and where to find pertinent information; 1992, 40 pp.; single copies free, \$35.00 per 100 plus \$4.00 shipping and handling. IIE Books, Institute of International Education, 809 United Nations Plaza, New York, NY 10017.

Chronicle Career Index, 1994-1995. Source book of vocational and educational guidance information. Annotated bibliographic listing of over 500 sources of publications and audiovisual materials. Order #502CI, ISBN 1-55631-226-1. \$14.25 plus \$1.43 shipping and handling. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, NY 13118-1190; 1-800-622-7284; fax: 315-497-3359.

Chronicle Financial Aid Guide, 1994/1995. Order #502A. ISBN 1-55631-225-3. \$22.47 plus \$2.25 postage and handling. Revised annually. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, NY 13118-1190; 1-800-622-7284; fax: 315-497-3359. Provides information on over 1,600 financial aid programs available to high school students, including programs sponsored by private

organizations and foundations; state and federal government sources; and national and international labor unions, both AFL-CIO affiliated and independent. A Subject Index to Programs gives easy access to programs for which a student may be eligible. A bibliography of resources is also listed.

Chronicle Four-year College Databook, 1994–1995. Lists 2,133 colleges and 780 majors. Data covered include degrees, accreditation, enrollment, admissions, costs, and aid. Order #502CM4, ISBN 1-55631-223-7, \$22.49 plus \$2.25 shipping and handling. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, NY 13118-1190; 1-800-622-7284; fax: 315-497-3359.

Chronicle Two-year College Databook, 1994–1995. Provides information on 2,422 colleges, 728 occupational-career programs, nondegree and degree programs, accreditation, enrollment, admissions, costs, and financial aid. Order #502CM2, ISBN 1-55631-224-5, \$22.46 plus \$2.25 shipping and handling. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, NY 13118-1190; 1-800-622-7284; fax: 315-497-3359.

- **Directory of Computer and High Technology Grants.** Richard M. Eckstein, Publisher. This directory lists 640 funding sources for computers, software, and high-tech-related grants and provides extensive profiles on foundations, corporations, and federal programs. First Edition cost is \$44.50 (add \$4.00 for handling). Research Grant Guides, Dept. 3A, P.O. Box 1214, Loxahatchee, FL 33470; 407-795-6129.

Directory of Graduate Programs, 14th Edition. Four volumes categorized by discipline, \$18.00 each. Volume A: natural sciences; Volume B: engineering, business; Volume C: social sciences, education; Volume D: arts, humanities, other fields. Educational Testing Service, P.O. Box 6014, Princeton, NJ 08541-6014.

Directory of Special Programs for Minority Group Members. Career information services, employment skills banks, financial aid sources (5th Edition, 1990, 348 pages), Garrett Park Press, Garrett Park, MD 20896. \$30.00.

Financial Aid for Minorities in Engineering and Science. Financial assistance, scholarship and fellowship programs, resources for further information, 1993, Garrett Park Press, P.O. Box 190, Garrett Park, MD 20896. \$4.95.

- **The Foundation Center.** The Foundation Center, 79 Fifth Avenue, New York, NY 10003, provides free library service through over 190 libraries across the country and publishes information about U.S. foundations and the grants they award, including the publication, *Foundation Grants to Individuals* (8th edition, 1993, \$55.00). Call toll-free 800-424-9836 for further information.

Fulbright Scholar Program Grants for Faculty and Professionals: Research and Lecturing Awards. (Current Edition) Available from the Council for International Exchange of Scholars, 3007 Tilden St., NW, Suite 5M, Washington, DC 20008-3009; 202-686-7877.

Fulbright and Other Grants for Graduate Study Abroad. List of grants for graduate study and research abroad, administered by the IIE for U.S. citizens. Request copy of brochure from U.S. Student Programs, Institute of International Education, 809 United Nations Plaza, New York, NY 10017, 212-984-5330.

Funding for U.S. Study: A Guide for Foreign Nationals. Over 600 awards in all fields and at all higher educational levels: undergraduate, graduate, postdoctoral, and professional. Grants and fellowships offered by U.S. and foreign governments, educational associations, research centers, foundations, corporations, and other organizations. Provides information of special value to foreign students and their counselors, including nationality requirements, number of awards made specifically to foreign nationals in relation to overall applicant group, and whether foreign nationals already resident in the U.S. may apply. Does not include awards of U.S. colleges and universities. 1989. 250 pp. book. 8 1/2 x 11. Indexes. ISBN 87206-181-7. \$39.95 pb. plus \$4.00 shipping and handling. IIE Books, Institute of International Education, 809 United Nations Plaza, New York, NY 10017.

Graduate School and You: A Guide for Prospective Graduate Students. Council of Graduate Schools, 3rd Edition, 1994. Available from the Council of Graduate Schools, 1 Dupont Circle, NW, Suite 430, Washington, DC 20036-1173, or call 202-223-3791. This publication is \$5.00. It can be obtained by sending a check for that amount with a request for the booklet.

The Grants Register. 1995–1997. Lisa Williams (ed.), St. Martin's Press, 175 Fifth Avenue, New York, NY 10010. Lists scholarships, fellowships, and grants at all levels of graduate study, all over the world, available from government agencies and international, national and private organizations. List price \$95.00. Biennial.

International Exchange Locator. A publication of the Liaison Group for International Education Exchange distributed through IIE Books, this book includes more than 200 pages of key information on nearly 100 organizations responsible for the exchange of over 100,000 U.S. and foreign nationals annually. Provides contact data on twelve committees and twenty-four subcommittees of the House and Senate that deal with exchange issues, as well as a listing of over 400 federal agency officials in twenty-one agencies with complete address and fax information. 1994. ISBN 87206-190-6. \$25.00 pb. plus \$4.00 shipping and handling. IIE Books, Institute of International Education, 809 United Nations Plaza, New York, NY 10017.

International Research and Exchanges Board (IREX). Programs administered by IREX include exchanges for two weeks to an academic year with Central and Eastern Europe, the states of the former Soviet region, and Mongolia; grants to promote new exchanges; collaborative projects in the social sciences and humanities; short-term travel grants; and language programs. The IREX programs provide access at the predoctoral and postdoctoral levels to East European and former Soviet universities and academies of sciences. For a program announcement describing the full range of IREX programs, write to the International Research & Exchanges Board, 1616 H Street, NW, Washington, DC 20006; 202-628-8188; fax: 202-628-8189.

Office of Naval Research. Supports research over a wide range of areas including applied mathematics, numerical analysis, discrete mathematics, operations research, signal analysis, statistics, and probability. Proposals for research grants and requests for information on ONR Programs should be addressed to: Math and Computer Science Division, Code 311, Office of Naval Research, Ballston Center Tower #1, 800 N. Quincy St., Arlington, VA 22217-5660. Information on ONR Fellowships is available from the Special Programs Department, Code 35, at the same address.

The Prentice Hall Guide to Scholarships and Fellowships for Math and Science Students (*A Resource for Students Pursuing Careers in Mathematics, Science, and Engineering*), by Mark Kantrowitz and Joann P. DiGennaro. This resource book focuses on the more than 250 scholarships and fellowships available to math and science students at the high school, undergraduate, and graduate levels. It also provides the latest information on over eighty contests and competitions, internships, summer employment offerings, and opportunities to study abroad. Included are financial aid programs that span the whole range of careers open to students in science, math, and engineering. Programs directed toward female and minority students can be found, as well as programs of a more general nature that do not restrict the student's field of study. The guide supplies information on: (1) how to uncover all possible sources of financial aid, assess career goals, obtain useful letters of recommendation, and get nominated for scholarships and fellowships; (2) how to choose an undergraduate school; and (3) how to improve one's chances of getting accepted to a graduate school. Information: Simon & Schuster, Mail

Order Customer Service, Rt. 59 at Brook Hill Dr., West Nyack, NY 10994; 800-288-4745; fax: 800-495-6991; e-mail: books@prenhall.com; ISBN 0-13-045345-5 (paper), 325 pp., \$19.95; ISBN 0-13-045337-4 (cloth), 325 pp., \$29.95.

Study Abroad, Volume 28, 1994-1995. Presents study programs worldwide for the years 1994-1995. Approximately 4,000 entries for more than 100 countries are included, covering a wide variety of fields. Trilingual (English/French/Spanish). 1,350 pp., pbk., 22cm x 11.5cm, \$24.95, Order No. U2851. Contact UNIPUB, 4611-F Assembly Drive, Lanham, MD 20706-4391; toll-free number 800-274-4888; in Europe, UNESCO, Place de Fontenoy, Paris 7, France.

U.K. Central Bureau Publications. The Central Bureau is the agency funded by the education ministries of the U.K. to provide the most-needed information on international education. IIE is the U.S. distributor for five Central Bureau books most widely used by U.K. students, librarians, and campus professionals in planning study and work abroad. IIE Books, Institute of International Education, 809 United Nations Plaza, New York, NY 10017.

- **U.S. Information Agency (USIA).** For information on USIA's international educational and cultural exchange programs, including the Fulbright Program, write the Office of Public Liaison, U.S. Information Agency, 301 Fourth Street, SW, Washington, DC 20547.

Vacation Study Abroad. Sara Steen (ed.). A guide to over 1,600 summer and short-term study programs conducted around the world by U.S. colleges and universities, foreign institutions, and private organizations. Contains information on courses, costs, scholarships, and accommodations. 1994/1995. Annual. \$36.95 (plus \$4.00 postage and handling). IIE Books, Institute of International Education, 809 United Nations Plaza, New York, NY 10017.

Work, Study, Travel Abroad: The Whole World Handbook 1992/1993. \$13.95 plus \$1.50 postage and handling. CIEE Publications, 205 East 42nd Street, New York, NY 10017. Prepayment necessary; Visa and MasterCard orders accepted. Call 800-349-2433.

Classified Advertisements

SUGGESTED USES for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

THE 1994 RATE IS \$70 per inch on a single column (one-inch minimum), calculated from the top of the type; \$40 for each additional $\frac{1}{2}$ inch or fraction thereof. No discounts for multiple ads or the same ad in consecutive issues. For an additional \$10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Advertisements in other sections of the classified pages will be set according to the advertisement insertion. Headlines will be centered in boldface at no extra charge. Classified rates are calculated from top of type in headline to bottom of type in body copy, including lines and spaces within. Any fractional text will be charged at the next $\frac{1}{2}$ inch rate. Ads will appear in the language in which they are submitted.

Prepayment is required of individuals but not of institutions. There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified advertising.

DEADLINES are listed on the inside front cover or may be obtained from the AMS Advertising Department.

U. S. LAWS PROHIBIT discrimination in employment on the basis of color, age, sex, race, religion or national origin. "Positions Available" advertisements from institutions outside the U. S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U. S. laws. Details and specific wording may be found near the Classified Advertisements in the January and July/August issues of the *Notices*.

SITUATIONS WANTED ADVERTISEMENTS from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. and Canada, or 401-455-4084 worldwide, for further information.

SUBMISSION: Advertising Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940, or via fax, 401-455-4004, or send e-mail to classads@math.ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Individuals are requested to pay in advance, institutions are not required to do so. AMS FAX 401-455-4004.

POSITIONS AVAILABLE

CALIFORNIA

CALIFORNIA INSTITUTE OF TECHNOLOGY Pasadena, CA

The Division of Physics, Mathematics and Astronomy is considering appointments in mathematics at all levels. Preferred areas include algebraic number theory, algebraic geometry, analysis, and mathematical physics. Applicants should write promptly to Dr. A. Kechris, professor and executive officer for mathematics, California Institute of Technology, 253-37 Sloan Laboratory, Pasadena, CA 91125. Please include a curriculum vitae, list of publications, and list of references.

Caltech is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

CALIFORNIA INSTITUTE OF TECHNOLOGY Pasadena, CA

Caltech invites applications for a **tenure-track position in modern number theory**. The subfields of particular interest are arithmetical algebraic geometry, automorphic forms/representations, L -functions, regulators, and Galois representations. Some related fields will also be considered. Excellence in research is the primary concern. Talented arithmeticians who received their Ph.D. in the past five years will be preferred. Applicants should write promptly to Dr. A. Kechris, professor and executive officer for mathematics, California Institute of Technology, 253-37 Sloan Laboratory, Pasadena, CA 91125.

Include a curriculum vitae, list of publications, and a description of research. Please also request three referees to send letters of evaluation directly to Dr. Kechris. All materials should arrive by January 1, 1995.

Caltech is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

CALIFORNIA STATE POLYTECHNIC UNIVERSITY Pomona, California Dean, College of Science

California State Polytechnic University, Pomona, Calif. is seeking applications and nominations for dean of the College of Science. Req. qualifications: earned doctorate; record of research, teaching and scholarship to support a sr. faculty appt.; three or more yrs. of admin. experience requiring academic leadership and stewardship. Application/job description call 909-869-3409; FAX: 909-869-4395 or e-mail to: SJCARDONA@CSUPomona.EDU. AA/EOE.

HARVEY MUDD COLLEGE Department of Mathematics Senior Position in Applied Mathematics

The department invites qualified candidates who can provide leadership in applied mathematics to apply for a senior position, which will begin July 1, 1995.

The successful candidate will be eligible for appointment to the rank of associate or full professor, and is expected to assume a term as department chair in the near future.

The anticipated hiring of several new faculty members over the next five years will give the successful candidate a unique opportunity to have a strong hand in shaping the department.

Applicants should have an earned doctorate or equivalent, strong administrative skills, an established record in research, and a commitment to excellence in teaching, research, and other scholarly activities. Candidates in all areas of applied mathematics will be considered. Salary will be commensurate with experience and qualifications.

Harvey Mudd College is a small, highly selective, privately supported institution with major programs in physics, chemistry, engineering, mathematics, biology, and computer science. About one-third of incoming students are National Merit Scholars. The curriculum emphasizes breadth in science and engineering with a commitment to studies in the humanities and social sciences. The program is rigorous and designed to prepared students for industry as well as graduate study. *Change* magazine reports that HMC was the first in the country in the percentage of its alumni who earn Ph.D.s. The college has an enrollment of 630 and is associated with four other undergraduate colleges and a graduate school in Claremont, forming an academic community of about 5,000 students. Faculty at HMC may also have an appointment to the graduate school faculty and can advise doctoral students in research. HMC has eleven mathematics and five computer science faculty and the Claremont Colleges combined have a total of forty-eight mathematics and computer science faculty. The department has an excellent network of both office and laboratory computer workstations.

Harvey Mudd College is an affirmative action, equal opportunity employer. Minority and women candidates are especially encouraged to apply. Preference will be given to applications received by December 1, 1994. Applicants should be prepared to have three letters of reference sent upon request and send a curriculum vitae, a description of their research, teaching, and administrative experience, to:

Professor Robert Borrelli
Search Committee Chair
Department of Mathematics
Harvey Mudd College
Claremont, CA 91711

UNIVERSITY OF CALIFORNIA, BERKELEY Fellowships in Mathematics and Molecular Biology

The Program in Mathematics and Molecular Biology has graduate and postdoctoral fellowship support available. Current topics in the program include geometry, topology, and sequence analysis of DNA, molecular dynamics, and mapping functions and algorithms for DNA and protein structure prediction. Other areas will be considered. Fellowships can be held at any university or college in the United States. **Deadline for Applications:** February 1, 1995. Women and minorities are encouraged to apply. **Apply to:** PMMB, 103 Donner Lab, #3206, University of

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California, Berkeley, CA 94720-3206. E-mail: sylviaj@violet.berkeley.edu.

UNIVERSITY OF CALIFORNIA, IRVINE Department of Mathematics Irvine, CA 92717-3875

Applications are invited for two tenure-track positions at the assistant/associate professor level. The search will be in areas that complement the existing strengths of the department. Priorities will be places on the following areas: 1) Algebra – with emphasis on algebraic geometry and arithmetic geometry; 2) Applied mathematics; 3) Analysis – with emphasis on harmonic analysis, dynamical systems, and ergodic theory; 4) Geometry – with emphasis on topology and geometric analysis.

Very strong potential in research and teaching is required for the assistant professor level. Candidates who may be considered for the associate professor level or above are expected to have an established research and teaching record. Applicants should send a curriculum vitae, publications lists, preprints and reprints to Recruitment Committee, at the above address. They should also arrange to have three letters of recommendation sent to the Recruitment Committee. The deadline for applications is November 30, 1994, or until the positions are filled. The University of California is an Equal Opportunity/Affirmative Action employer committed to excellence through diversity.

UNIVERSITY OF CALIFORNIA, LOS ANGELES Department of Mathematics Regular Positions in Pure and Applied Mathematics

The UCLA Department of Mathematics invites applications for three or more tenure-track positions in pure or applied mathematics. Exceptional promise in research and teaching is required. Positions are initially budgeted at the assistant professor level, but sufficiently outstanding candidates will be considered at higher levels. Specific search areas are: statistics; applied and computational mathematics; logic; geometry, topology and dynamical systems; analysis and differential equations; algebra, number theory and combinatorics; mathematical developments arising from physics. Teaching load is an average of 4.5 quarter courses per year. Positions are subject to availability of resources and administrative approval. To apply, send electronic mail to search@math.ucla.edu or write to John Garnett, chair, Department of Mathematics, University of California, Los Angeles, CA 90024-1555. Attn: Staff Search. UCLA is an equal opportunity/affirmative action employer.

UNIVERSITY OF CALIFORNIA, LOS ANGELES Department of Mathematics

TEMPORARY POSITIONS

Subject to availability of resources and administrative approval:

(1) Two E. R. Hedrick Assistant Professorships. Applicants must show very strong promise in research and teaching. Salary \$39,600. Three-year appointment. Teaching load: four quarter courses per year, which may include one advanced course in the candidate's field. Preference will be given to applications completed by January 1, 1995.

(2) One or two research assistant professorships in computational and applied mathematics. Applicants must show very strong promise in research and teaching. Salary \$39,600. One-year appointment, probably renewable up to two times. Teaching load: at most four quarter courses per year, which may include one advanced course in the candidate's field. Preference will be given to applications completed by January 1, 1995.

(3) One adjunct assistant professorship or lectureship in the Program in Computing (PIC). Applicants for the adjunct position must show very strong promise in teaching and research in an area related to computing. Teaching load: four quarter programming courses and a more advanced quarter course per year. One-year appointment, probably renewable once. Salary range \$39,600-\$47,000. Applicants for the lectureship must show very strong promise in the teaching of programming. An M.S. in Computer Science or equivalent degree is preferred. Teaching load: six quarter programming courses per year. One-year appointment, probably renewable one or more times, depending on the needs of the program. Salary is \$34,248 or more, depending on experience. Preference will be given to applications completed by February 1, 1995.

(4) An adjunct assistant professorship. One-year appointment, probably renewable once. Strong research and teaching background required. Salary \$35,900-\$40,500. Teaching load: five quarter courses per year.

(5) Possibly one or more positions for visitors.

To apply, send electronic mail to: search@math.ucla.edu or write to John B. Garnett, chair, Department of Mathematics, University of California, Los Angeles, CA 90024-1555, Attn: Staff Search. UCLA is an equal opportunity/affirmative action employer.

UNIVERSITY OF CALIFORNIA, SANTA BARBARA Department of Mathematics

The University of California, Santa Barbara, invites applications in **ANALYSIS** and **ALGEBRAIC GEOMETRY** for the following positions in the Department of Mathematics, beginning fall 1995.

TWO TENURE-TRACK POSITIONS – tenure-track appointments at the assistant professor level, effective July 1, 1995. Applicants should be in either analysis or algebraic geometry.

In analysis, preference will be given to candidates in harmonic analysis, several complex variables, and functional analysis (linear or non-linear). Demonstrated research excellence and potential to become an effective teacher are required. Candidates who best enhance the long term research plans of the department will be given preference.

SPECIAL VISITING POSITIONS – Subject to availability of funds, one or more special one-year visiting assistant professorships in analysis or algebraic geometry, with possibility of a second year, carrying a teaching load of five or six one-quarter courses per year. Demonstrated research excellence and teaching effectiveness are both required.

Applicants should send the following materials to either the Analysis Committee, the Algebraic Geometry Committee, or the Visiting Appointments Committee, as appropriate, at the Department of Mathematics, University of California, Santa Barbara, CA 93106-3080: a vita, a publication list, and a statement of research interests. Include an e-mail address if available. Applicants should also arrange to have at least four letters of recommendation sent to the appropriate committee. Applicants for the tenure-track positions will automatically be considered for any visiting positions upon request, so duplicate applications are unnecessary. Applications which are complete by January 3, 1995, will be given full consideration.

UCSB is an affirmative action/equal opportunity employer.

Mathematics Department UNIVERSITY OF CALIFORNIA Santa Cruz, CA 95064

The department expects to have visiting assistant professorships in mathematics beginning fall 1995 (subject to availability of funding). Appointees will be expected to teach, pursue their research, and perform service. These positions are available for periods ranging from one quarter to the full academic year, with a possible extension. Minimum qualifications: Ph.D. [or equivalent] in mathematics and demonstrated achievements or potential for excellence in research, teaching, and service. Salary: \$35,900. Available: fall 1995. Application deadline: December 14, 1994. Please refer to #T94-03. Applicants should send vitae, summary of research and teaching experience, and three letters of recommendation (at least one letter addressing teaching experience and ability) to: Recruitment Committee, Mathematics Department, University of California, Santa Cruz, CA 95064.

Full consideration is only guaranteed for applications received by the deadline. UCSC is an AA/EEO/IRCA employer.

Mathematics Department UNIVERSITY OF CALIFORNIA Santa Cruz, CA 95064

The Mathematics Department at the University of California, Santa Cruz, is recruiting for two tenure-track assistant professors Step I-III; one

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in topology (467) and one in partial differential equations (475). Both positions would be effective July 1, 1995. The teaching load is four one-quarter courses per year. Minimum qualifications: Ph.D. [or equivalent] in mathematics and demonstrated achievements or potential for excellence in research, teaching, and professional service. Step commensurate with experience. Salary range: \$35,900 – \$38,800. Application deadline: December 14, 1994. Please refer to position numbers indicated above in your correspondence. Applicants should send a curriculum vitae, a summary of their research and teaching experience, and four letters of recommendation (at least one letter addressing teaching experience and ability) to: Recruitment Committee, Mathematics Department, University of California, Santa Cruz, CA 95064.

Full consideration can only be guaranteed for applications received by the deadline. Inquiries [not applications] can be sent to mathrcr@cats.ucsc.edu. UCSC is an AA/EEO/IRCA employer.

UNIVERSITY OF SOUTHERN CALIFORNIA Los Angeles, California

The Department of Mathematics anticipates a tenure-track or possibly tenured position in mathematical biology open at all levels. The applicant's areas of research should concern the analysis of genome information, including the sequence databases. Strength in computational analysis, algorithms, and combinatorics is desirable. Applicants must show strong research promise and possess excellent communications skills for teaching undergraduate mathematics courses.

To apply, please submit the following materials in a single package: letter of application (including your e-mail address and fax number), and a curriculum vitae. Candidates for junior positions should also provide at least three letters of recommendation. Mail application to: Chair of Appointments Committee, Department of Mathematics-DRB 155, University of Southern California, Los Angeles CA 90089-1113.

USC is an Equal Opportunity/Affirmative Action employer. Women and minorities are especially encouraged to apply.

DELAWARE

UNIVERSITY OF DELAWARE Department of Mathematical Sciences

Applications are invited for a tenure-track position in industrial applied mathematics beginning September 1, 1995. Candidates should have Ph.D. and demonstrated research potential in applied math. Preference given to candidates who have potential to interact with faculty in following areas; fluid dynamics (transonic aerodynamics, viscoelasticity); inverse problems (tomography, scattering); wave propagation (acoustic, electromagnetic); scientific computing and solid mechanics (elasticity, thermoelasticity). Commitment to teaching essential. Preference will be given to candidates who evidence experience and/or ability in develop-

ing research links and student internships with industry (preferably Mid-Atlantic region) or national laboratories. Send C. V., reprints and/or preprints and three letters of reference to Dr. Ralph Kleinman, chair, Search Committee, Department of Mathematical Sciences, University of Delaware, Newark, DE 19716 by January 15, 1995, for full consideration. The University of Delaware is an equal opportunity employer which encourages applications from qualified minority group members and women.

FLORIDA

UNIVERSITY OF CENTRAL FLORIDA Department of Mathematics

Applications are invited for at least one tenure-track position at the assistant and/or associate professor level beginning August 1995. Applicants should possess a Ph.D. degree by August 8, 1995, a commitment to excellence in teaching, and the potential to conduct quality research. This appointment (or these appointments) will be made in the areas of abstract algebra, probability, stochastic processes, and mathematical statistics. The areas of graph theory and combinatorics may be considered if strong candidates are unavailable in the desired areas. The department offers a B.S. in Mathematics with options in both pure and applied mathematics, a M.S. in Mathematical Science, and a Ph.D. in Mathematics with emphasis in applied and industrial mathematics. Candidates should send a detailed résumé and arrange for at least three letters of recommendation and a transcript to be sent to: Dr. Lokenath Deb-nath, chair, c/o Search Committee, Department of Mathematics, University of Central Florida, Orlando, Florida 32816-1364, postmarked by December 1, 1994. The University is an equal opportunity affirmative action employer. Women and minority candidates are strongly encouraged to apply. As an agency of the State of Florida, UCF makes all application materials and selection procedures available for public review.

UNIVERSITY OF FLORIDA

Applications are invited for two tenure-track positions at the assistant professor level in the following areas: combinatorics, probability and topology/dynamical systems.

Appointments commence in August 1995. Applicants must show strong research promise and are expected to excel in teaching undergraduate mathematics courses. Applicants should forward a curriculum vitae and a list of publications to: Chair of Search Committee, Department of Mathematics, University of Florida, Gainesville, FL 32611-8000.

Applicants should supply evidence of commitment to teaching and arrange for at least three letters of recommendation to be forwarded to the address above. Completed applications and supporting letters are due December 20, 1994.

The department especially welcomes applications from women and minority candidates.

The University of Florida is an EEO/AA institution. Anyone requiring special assistance in completing the application should contact the search committee chairperson.

GEORGIA

GEORGIA INSTITUTE OF TECHNOLOGY

The School of Mathematics expects to have some visiting and tenure-track positions in several areas of applied mathematics at various levels beginning in fall 1995. Candidates with strong research and teaching records or potential should send a résumé, at least three letters of reference, and a summary of future research plan to The Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, Georgia 30332-0160 U.S.A. Applications will be reviewed beginning November 30, 1994. Georgia Tech., a member of the University System of Georgia, is an Equal Opportunity/Affirmative action Employer.

VALDOSTA STATE UNIVERSITY Head, Department of Mathematics and Computer Science

Valdosta State University is accepting applications for a head of the Department of Mathematics and Computer Science at the rank of associate or full professorship beginning July 1, 1995. Ph.D. in mathematics or computer science and strong teaching and research skills required, some administrative experience preferred. Department includes nineteen full-time faculty and over 200 majors and offers six degree programs, including applied mathematics and computer information systems.

Applicants should submit a letter of application, complete dossier, and at least three letters of recommendation by Nov. 15 to Thomas E. Dasher, acting dean, College of Arts and Sciences, VSU, Valdosta, GA 31698. Valdosta State University is an AA/EO employer.

VALDOSTA STATE UNIVERSITY Mathematics Position

The Department of Mathematics and Computer Science at Valdosta State University invites applications for a nine-month tenure-track position at the assistant/associate professor level beginning September 1, 1995.

Preference will be given to candidates with a Ph.D. in analysis, differential equations, or numerical differential equations. ABD with a Master's degree in mathematics required. Applicants should have a commitment to excellence in teaching and continued scholarly activity. AA/EOE M/F.

Send a letter of application, résumé, unofficial transcripts of all undergraduate and graduate work, and arrange for at least three letters of recommendation to be sent by November 15, 1994, to: Ashok Kumar, Mathematics Search Committee, Department of Mathematics and

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Computer Science, Valdosta State University,
Valdosta, GA 31698-0040.

ILLINOIS

NORTHWESTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road,
Evanston, Illinois 60208-2730

Applications are invited for a newly created position of lecturer in mathematics starting in September, 1995. This position carries a two course teaching responsibility in each of the three quarters of the academic year. The term of appointment will be for one year and will be renewable twice upon evidence of excellence in teaching. Candidates must present solid evidence of effective teaching and quality research. Teaching experience of at least two courses is expected, and teaching performance should be substantiated, if possible, by tabulated student evaluations. Send applications and three letters of reference to chairperson, Personnel Committee, Department of Mathematics, Northwestern University, Evanston, IL 60208-2730. Initial inquiries may be sent to: hiring@math.nwu.edu. In order to receive full consideration, applications should be received by December 15, 1994. Northwestern University is an Equal Opportunity/Affirmative Action employer and encourages applications from minority and women candidates.

NORTHWESTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road,
Evanston, Illinois 60208-2730

The mathematics department will sponsor an Emphasis Year in analysis/applied analysis. This program will include two two-year assistant professorship positions starting September 1995, and possible visiting positions for more senior mathematicians for part of the academic year 1995-1996, contingent upon availability of funds.

Applications should be sent to the Emphasis Year secretary, Department of Mathematics, Northwestern University, Evanston, IL 60208-2730, and include a curriculum vitae and three letters of recommendation. In order to ensure full consideration, an application should be received by January 15, 1995. Northwestern University is an affirmative action, equal opportunity employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

NORTHWESTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road,
Evanston, Illinois 60208-2730

Applications are invited for an anticipated tenure-track assistant professor position starting September 1995. Priority will be given to exceptional research mathematicians. Fields of

interest within the department include algebra, analysis, dynamical systems, probability, partial differential equations, and topology. Northwestern is an affirmative action, equal opportunity employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply. Candidates should arrange that at least three letters of recommendation be sent to Prof. J. Sally, chair, Personnel Committee, Department of Mathematics, Northwestern University, Evanston, Illinois 60208-2730. Initial inquiries may be sent via e-mail to hiring@math.nwu.edu. In order to receive full consideration, applications should be received by December 15, 1994. Hiring is contingent upon eligibility to work in the United States.

SOUTHERN ILLINOIS
UNIVERSITY AT CARBONDALE
Carbondale, Illinois 62901
Continuing Position
Department of Mathematics

Applications are invited from qualified candidates for a tenure-track position at the assistant professor level beginning on August 16, 1995. Ph.D. in mathematics required. Preference will be given to applicants in the areas of algebra, combinatorics, ordinary or partial differential equations, probability and topology. Candidates must have demonstrated excellence in research or potential for such. Applicants should provide evidence of excellence in teaching, and foreign applicants must provide evidence of the ability to teach in English effectively. Send letter of application, résumé and three letters of recommendation to: Continuing Position, c/o Ronald B. Kirk, Chair, Department of Mathematics, Southern Illinois University at Carbondale, Carbondale, Illinois 62901.

The closing date is December 1, 1994, or until the position is filled. SIUC IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. Women and minorities are particularly encouraged to apply.

MAINE

COLBY COLLEGE
Department of Mathematics
and Computer Science
Waterville, Maine 04901

**Carter Professor of Mathematics and
Computer Science**

Colby invites nominations and applications for Carter Professor of Mathematics and Computer Science, effective September 1, 1995. Necessary qualifications include: a Ph.D. in mathematics or computer science; a distinguished career as scholar and teacher; commitment to liberal arts, undergraduate mathematics, and computer science education.

The Carter Professorship is an endowed position for a nationally recognized scholar and teacher. The Carter Professor is expected to maintain a distinguished research program and teach undergraduate mathematics, sta-

tistics, and/or computer science classes and participate in the departmental programs. The Professorship includes funds for research and travel.

Colby is a highly selective college of 1,700 students and 165 faculty. Its Department of Mathematics and Computer Science has nine full-time and two part-time faculty members who are active researchers and teach courses in mathematics, computer science, and statistics. Normal annual teaching load is five courses, one of which may be during the January Program. Colby is an AA/EO employer and encourages applications from women and minorities.

The campus of 700 acres is on the outskirts of Waterville, a city of 20,000. Waterville is located on the Kennebec River in an area of lakes, forests, and farms. Mountains (including Saddleback and Sugarloaf ski areas) and seacoast (including Acadia National Park) are within a two-hour drive. Boston is approximately a three-hour drive.

Send nominations or applications in hard copy to Dale Skrien, chair, Department of Mathematics and Computer Science (djskrien@colby.edu). Review of applications will begin on October 15, 1994, and will continue until the position is filled.

COLBY COLLEGE
Department of Mathematics
and Computer Science

We have two tenure-track openings at the assistant professor level, commencing September 1, 1995. Ph.D. required. The salary is competitive, and based on experience.

Colby is a small, private, highly selective liberal arts college located in central Maine. The student body numbers some 1,700, the faculty 165. The Department of Mathematics and Computer Science currently numbers nine full-time and two part-time, all of whom have the Ph.D. We have major and minor programs in mathematics and computer science.

We are a young, active department, which places a high value on both teaching and research. The annual teaching load is five courses. The largest class size is thirty.

For one of the openings, we prefer someone with a pure mathematics background. For the other position we prefer someone with a strong computer science and mathematics background. Candidates who are able to demonstrate excellence in teaching are likely to be ranked higher in our selection process.

Colby actively encourages applications from women and minority candidates. We are an EO/AA employer.

Review of applications will begin on December 10, 1994, and will continue until the positions are filled.

Send a letter of application and a current curriculum vita in hard copy to: **Dale Skrien, chair, Department of Mathematics and Computer Science, Colby College, Waterville, Maine 04901** (djskrien@colby.edu). Also, arrange for three letters of reference to be sent to the same address. These letters should deal with both your research and your teaching abilities.

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MARYLAND

THE JOHNS HOPKINS UNIVERSITY Department of Mathematical Sciences

The Department of Mathematical Sciences at the Johns Hopkins University invites applications for an anticipated faculty position to begin in fall 1995. The core areas of the department are discrete mathematics, matrix and numerical analysis, operations research and optimization, and probability and statistics. Candidates with a strong background in one of these areas or in the area of numerical mathematics are encouraged to apply. We especially welcome applicants who can interact effectively with faculty and students in the School of Engineering, particularly in such thrust areas as information, biomedical, environmental, and materials sciences. A broad and outstanding mathematical background is essential. Applicants at all levels will be considered. Selection will reflect demonstration (for senior applicants) and promise (for junior applicants) of excellence in research, teaching and innovative applications. A Ph.D. degree is required. Applications in the areas of algebra, analysis, geometry, number theory, and topology will not be accepted by the Mathematical Sciences Department, which is distinct from the Mathematics Department.

Minority and women candidates are encouraged to apply. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer.

Applicants are requested to send initially only a curriculum vita with a cover letter describing professional interests and aspirations. Recommendation letters, transcripts, preprints and reprints are to be furnished only upon request. Please address applications to:

Faculty Search Committee
Department of Mathematical Sciences
The Johns Hopkins University
220 Maryland Hall
Baltimore, Maryland 21218-2689.

Applications are requested by January 15, 1995.

MASSACHUSETTS

HARVARD UNIVERSITY

Benjamin Peirce Lectureships. This position is suited for people who have recently received their Ph.D. The position carries the rank of assistant professor. The appointments are for three years with a starting salary of approximately \$42,200 (for the nine-month academic year) which can be augmented by teaching in the summer school or by working on a research contract if funds are available. The teaching commitment is three half-courses per year. Usually, one of the half-courses will be on a topic of the lecturer's choice. Application forms may be obtained by writing to: Benjamin Peirce Lectureships, Department of Mathematics, Harvard University, One Oxford Street, Cambridge, MA 02138.

Applications must be filed by December 30, 1994. Harvard is an Equal Opportu-

nity/Affirmative Action Employer, and particularly encourages applications from women and minority candidates.

NORTHEASTERN UNIVERSITY Department of Mathematics

Applications from outstanding candidates are invited for the Stone Professorship of Applied Statistics, effective September 1, 1995. Necessary qualifications include a Ph.D. in mathematics or statistics, a distinguished career of teaching, proven ability to collaborate across disciplines, and internationally recognized research with extensive grant success.

The Stone Professor will play a leadership role in developing interdisciplinary collaborations centered on research applications of statistics and in developing educational programs in applied statistics. The Stone Professorship is a tenured position at the full professor level.

The Mathematics Department has thirty-nine full time faculty and offers both M. S. and Ph.D. degrees with specialization in combinatorics, differential equations, probability and statistics, and in pure mathematics.

Northeastern University does not discriminate on the basis of race, color, religion, sex, sexual orientation, age, national origin, veteran or disability status in admission to, access to, treatment in or employment in its programs and activities.

Nominations and applications may be submitted to Donna Marlowe, Northeastern University, Department of Mathematics, 567 Lake Hall, Boston 02115.

WILLIAMS COLLEGE Department of Mathematics Williamstown, Massachusetts 01267

Anticipated tenure-eligible position in mathematics or applied mathematics, beginning fall 1995, probably at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in both teaching and research is essential; a doctorate is required.

Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Evaluation of applications will begin November 15 and continue until the position is filled. As an EEO/AA employer, Williams especially welcomes applications from women and minority candidates.

WILLIAMS COLLEGE Department of Mathematics Williamstown, Massachusetts 01267

Anticipated visiting position for the 1995-96 year, probably full-time, probably at the rank of assistant professor, in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research, and doctorate expected. Please have vita and three letters of recommendation on teaching and research sent to Visitor Hiring Committee. Evaluation of applications will begin

November 15 and continue until the position is filled. As an EEO/AA employer, Williams especially welcomes applications from women and minority candidates

MINNESOTA

UNIVERSITY OF MINNESOTA Associate Director of the Minnesota Center for Industrial Mathematics and Full Professor in the School of Mathematics

The School of Mathematics at the University of Minnesota is establishing the Minnesota Center for Industrial Mathematics. The School is seeking to hire a senior mathematician as associate director of the Center. The associate director will hold the position of tenured full professor in the School of Mathematics.

Duties: The associate director will work with the director of the Center to implement the various missions of the Center, teach undergraduate and graduate courses, and direct Master's and Ph.D. students within the programs of the School of Mathematics and the Minnesota Center for Industrial Mathematics. An important responsibility of the associate director will be to initiate interactions with industry for the purpose of setting up joint research projects with faculty associated with the Center and with graduate students.

Qualifications: Ph.D. in mathematics or applied mathematics with strong science background. Experience in research projects with industry, government laboratories, or other institutions outside of academia is desirable but not essential.

Salary will be commensurate with background and experience. Send current curriculum vitae, minimum three letters of recommendation, and description of research experience by January 1, 1995 to: Professor Mitchell Luskin, chair, Search Committee for Industrial Mathematics, School of Mathematics, University of Minnesota, 127 Vincent Hall, 206 Church Street, Minneapolis, MN 55455.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

UNIVERSITY OF MINNESOTA Assistant or Associate Professor at the Minnesota Center for Industrial Mathematics and the School of Mathematics

The School of Mathematics at the University of Minnesota is establishing the Minnesota Center for Industrial Mathematics. The School is seeking to hire an entry-level mathematician to work with the director and the associate director of the Center to implement the missions of the Center.

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Duties: teach undergraduate and graduate courses, and direct Master's and Ph.D. students within the programs of the School of Mathematics and the Minnesota Center for Industrial Mathematics. An important responsibility of the position will be to initiate interactions with industry for the purpose of setting up joint research projects with faculty associated with the Center and with graduate students.

Qualifications: Ph.D. in Mathematics or Applied Mathematics with strong science background. Experience in research projects with industry, government laboratories, or other institutions outside of academia is desirable.

Salary will be commensurate with background and experience. Send current curriculum vitae, minimum three letters of recommendation, and description of research experience by February 1, 1995 to: Professor Mitchell Luskin, chair, Search Committee for Industrial Mathematics, School of Mathematics, University of Minnesota, 127 Vincent Hall, 206 Church Street, Minneapolis, MN 55455.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, religion, national origin, sex, age, marital status, disability, public assistance status, veteran status, or sexual orientation.

MISSISSIPPI

MISSISSIPPI STATE UNIVERSITY Department of Mathematics and Statistics

Applications are invited for five or more anticipated tenure-track or visiting positions at the rank of assistant professor and above for the 1995-96 academic year. Requirements include a doctoral degree, demonstrated success or strong potential in research, and a commitment to effective undergraduate and graduate teaching. Candidates with research interests in algebra, analysis, applied probability/statistics, computational mathematics, ordinary/partial differential equations, topology, mathematical biology, mathematical modeling, and mathematics education are encouraged to apply. Candidates having substantial research records in mathematics education or an applied area are especially encouraged to apply for senior level positions. Salary is competitive and commensurate with qualifications.

The department offers graduate programs leading to an M.S. in both mathematics and statistics and a Ph.D. in mathematical sciences. Opportunities exist for applicants with an interest in interdisciplinary research or consulting. Applicants should submit a résumé, a completed AMS Application Cover Sheet (see July/August 1994 *AMS Notices*), and arrange for three letters of recommendation to be sent to: John R. Graef, chair, Screening Committee, Department of Mathematics and Statistics, Mississippi State University, Mississippi State, MS 39762 (e-mail: graef@math.msstate.edu; fax: 601-325-0005). The screening process will begin on December 1, 1994, and continue until all positions are filled.

The department especially welcomes applications from women and minority candidates. Mississippi State University is an AA/EEO employer.

NEW HAMPSHIRE

DARTMOUTH COLLEGE John Wesley Young Research Instructorship in Mathematics

The John Wesley Young Research Instructorship is a two-year post-doctoral appointment for promising new or recent Ph.D.s whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, combinatorics, computer science, differential geometry, logic and set theory, number theory, probability and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's specialty and include elementary, advanced, and (at instructor's option) graduate courses. Nine-month salary of \$35,000 supplemented by summer (resident) research stipend of \$7,778 (two-ninths). Send letter of application, résumé, graduate transcript, thesis abstract, description of other research activities and interests if appropriate, and three or preferably four letters of recommendation (at least one should discuss teaching) to Betty Harrington, Department of Mathematics, 6188 Bradley Hall, Hanover, NH, 03755-3551. Applications received by January 15 receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to affirmative action and strongly encourages applications from minorities and women.

NEW JERSEY

RUTGERS UNIVERSITY

Subject to budget constraints, Rutgers University - Camden expects to hire three computer scientists (at least one senior level) and one mathematician, to start fall 1995, rank negotiable. Those who can teach both math. and comp. sci. are especially encouraged to submit letters of interest. Send a vita and arrange for three or four letters of recommendation to be sent directly to J. Gerver, Dept. of Mathematical Sciences, Rutgers University, Camden, NJ 08102.

RUTGERS UNIVERSITY-NEWARK Assistant Professor of Mathematics

The Department of Mathematics and Computer Science invites applications for an anticipated tenure-track assistant professor position beginning September 1995. Candidates must have a Ph.D., have a strong research record, and be able to demonstrate outstanding promise, as well as a commitment to effective teaching. Research interests of the department include the following: representation theory, automor-

phic forms, number theory, low dimensional topology, Riemann surfaces, and algebraic geometry.

Applicants should arrange for a curriculum vitae and at least four letters of recommendation, including one which addresses teaching, to be sent to William Keigher, associate chair, Department of Mathematics and Computer Science, Rutgers University, Newark, NJ, 07102. Responses may also be e-mailed to math@andromeda.rutgers.edu. Processing of applications will begin in December 1994.

Rutgers University is an equal opportunity/affirmative action employer.

NEW MEXICO

NEW MEXICO STATE UNIVERSITY Department of Mathematical Sciences

The department invites applications for tenure-track and visiting positions in pure and applied mathematics and statistics for academic year 1995-1996. The department has thirty-two tenure-track positions, and offers B.S., M.S., and Ph.D. degrees. New tenure-track appointments are expected to be at the assistant professor level. Applicants should demonstrate strong potential for success in both teaching and research.

A complete application consists of an introductory letter from the applicant, a curriculum vita, and three or more letters of recommendation. The applicant's letter should identify research area and interest in tenure-track or visiting positions; letters of recommendation should address abilities in both research and teaching. For tenure-track positions, an applicant's letter and vita must be received by December 15, and other supporting materials must be received by January 9. Tenure-track appointments are made during the spring semester; visiting appointments are made as vacancies occur.

Application materials should be sent to: Hiring Committee, Department of Mathematical Sciences, New Mexico State University, Las Cruces, NM 88003-8001.

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OKLAHOMA

UNIVERSITY OF OKLAHOMA Department of Mathematics

Nominations and applications are invited for the position of chair of the Department of Mathematics. The appointment is to be effective by the start of the fall 1995 semester or earlier. Candidates must possess an earned doctorate, a substantial record of research achievement, a commitment to excellence in teaching, and leadership and administrative abilities appropriate to a department that is dedicated to a balanced program of quality research and teaching. The Mathematics Department has over thirty faculty and approximately seventy graduate students. There are active research programs in a wide range of topics. The scientific activity of the department is further enhanced

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by a substantial endowment for discretionary funds. The department offers programs for the bachelor's, master's, and Ph.D. degrees. Candidates should send a cover letter, vita, selected reprints, and names and addresses of four references (at least one of whom could address the candidate's administrative abilities) to:

Dr. Paul Goodey, Chair Search
Committee

Department of Mathematics
University of Oklahoma

Norman, Oklahoma 73019-0315

Screening will begin on November 1, 1994, and continue until the position is filled.

The University of Oklahoma is an Equal Opportunity/Affirmative Action Employer. Women and minorities are encouraged to apply. OU has a policy of being responsive to the needs of dual-career couples.

PENNSYLVANIA

CARNEGIE MELLON UNIVERSITY Department of Mathematics

The Department of Mathematics expects to make at least one tenure-track appointment to begin in the fall of 1995. We seek candidates in the areas of research which strongly intersect those of the current faculty of the department. Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have three letters of recommendation sent to: Tenure-track Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

CARNEGIE MELLON UNIVERSITY CENTER FOR NONLINEAR ANALYSIS Department of Mathematics

The Center for Nonlinear Analysis expects to make several post-doctoral appointments for 1995-96 in the area of applied analysis. This is a one-year (twelve-month) joint appointment by the Center and Department of Mathematics. Recipients will teach at most one course per semester. Applicants should send a vita, list of publications, a statement describing current and planned research, and arrange to have at least three letters of recommendation sent to the committee. The deadline for application is January 20, 1995; late applications may be considered on a space-available basis. All communications should be addressed to: Post-doctoral Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

CARNEGIE MELLON UNIVERSITY Department of Mathematics

The Department of Mathematics is seeking applications and nominations for the position of professional head of the department, beginning fall 1995.

Carnegie Mellon has 4,400 undergraduate and 2,700 graduate students. The department has a tenure-track faculty of twenty-six.

The department has strong research programs in applied analysis, continuum mechanics, discrete mathematics, logic, numerical analysis, and stochastic analysis. It includes the Center for Nonlinear Analysis, a major center for the study of nonlinear differential equations and their applications.

The department offers a Ph.D. in mathematics and also has interdisciplinary programs in the following areas:

Algorithms, combinatorics and optimization, applied logic, and mathematical finance.

Candidates should have an international reputation for research in areas compatible with those of the department. They should have strong interest in education and have demonstrated leadership qualities. Applications and nominations should be sent to:

Search Committee
Department of Mathematics
Carnegie Mellon University
Pittsburgh, PA 15213

E-mail: pm1w@andrew.cmu.edu

Fax: 412-268-6380

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PENN STATE ERIE, BEHREND COLLEGE

Mathematics Faculty Position: A tenure-track assistant professor position for fall 1995. Applicants must have a strong commitment to undergraduate teaching, including topology and abstract algebra. We are seeking someone with research interests in an area of applied mathematics, numerical analysis, or partial differential equations. The successful candidate will be expected to develop an externally funded research program involving undergraduates. Ph.D. required; postdoctoral and teaching experience desirable. Behrend is a four-year and graduate college offering the B.S. in mathematics within the Penn State system. Application deadline is November 15, 1994. Send résumé, transcripts, a brief description of research interests, and arrange that three letters of reference be sent to Dr. Roger Knacke, Division of Science, Department Math-N, The Pennsylvania State University at Erie, PA 16563-0203.

An Affirmative Action/Equal Opportunity Employer. Women and minorities encouraged to apply.

UNIVERSITY OF PITTSBURGH Department of Mathematics

The Department of Mathematics of the University of Pittsburgh invites applications for the position of department chairperson, beginning fall 1995.

Located in urban Pittsburgh, the University of Pittsburgh is a research university with approximately 10,000 graduate and 18,000 undergraduate students. The department currently has thirty-five faculty members with research specialties including algebra, analysis, differential equations, differential geometry, discrete mathematics, foundations, mathematical biology, numerical analysis, scientific computing, and topology.

Candidates should have research and teaching credentials consistent with a tenured appointment at the rank of full professor, as well as a commitment to aggressive promotion of excellence in research and teaching at all levels. Administrative experience is also desirable. Interested parties should contact Professor Charles Hall, chairperson Search Committee, Department of Mathematics, University of Pittsburgh, Pittsburgh, PA 15260 (hall@vms.cis.pitt.edu, 412-624-8379).

Complete applications should include a curriculum vitae and the names and addresses of three references. For full consideration, inquiries should be received by October 15, 1994. Women and minorities are especially encouraged to apply. The University of Pittsburgh is an EO/AA employer.

RHODE ISLAND

BROWN UNIVERSITY

J. D. Tamarin Assistant Professorship. Three-year appointment, beginning July 1, 1995. Competitive salary. Teaching load: two courses per semester (6 hours per week). Applicants (regardless of age) should have received the Ph.D. degree before the start of the appointment, but no earlier than January 1, 1993. Applicants should have strong research potential and a commitment to teaching. Field of research interest will be taken into account. A curriculum vitae, a completed application form, and three letters of recommendation should be received by December 31, 1994. Requests for application forms and all other inquiries should be addressed to Tamarin Search Committee, Department of Mathematics, Box 1917, Brown University, Providence, RI 02912. Brown University is an Equal Opportunity/Affirmative Action Employer.

TEXAS

UNIVERSITY OF TEXAS AT ARLINGTON Department of Mathematics

The department invites applications for possibly two to three anticipated tenure-track positions beginning with the fall semester, 1995. We seek candidates in various areas of mathematics which are complementary to those of the current faculty and would enhance and support the goals of the department. Application deadline is December 15, 1994, or until positions are filled. Salary and rank are commensurate with qualifications which must include the Ph.D. degree (in hand or expected by Sept. 1995). Assistant professor candidates must show strong poten-

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tial for excellence in teaching and research. For an associate or full professorial appointment, the candidate must have excellent teaching credentials and a nationally established research record; some success in attracting outside funding is preferred. Please send a résumé and three letters of recommendation to:

Chairman
Recruiting Committee
University of Texas at Arlington
Department of Mathematics
Box 19408
Arlington, TX 76019-0408

The University of Texas at Arlington is an Affirmative Action/Equal Opportunity Employer.

UTAH

UNIVERSITY OF UTAH Department of Mathematics

University of Utah, Department of Mathematics, invites applications for the following positions. Availability of positions is contingent upon funding.

1. Several nonrenewable three-year instructorships. Persons of any age receiving Ph.D. degrees in 1994 or 1995 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be \$36,500; future cost of living increases are contingent on action by the State Legislature. Duties consist of teaching five courses during the three quarter academic year.

2. One C. R. Wylie instructorship. The term of this instructorship is one year, but it may be renewed for up to three years. It will be awarded either to an incoming instructor or to one of the instructors already in residence on the basis of ability and potential in teaching and research. The stipend is \$40,500. Duties consist of teaching four courses during the three quarter academic year.

3. One or more visiting faculty positions of one year or less in any of the professorial ranks. Selection will be based on potential contributions to the department's research program, and on teaching ability.

It is expected that offers of instructorships will begin on January 1, 1995, but applications for all positions will be accepted until January 31, 1995, or until all positions are filled.

Applications for any of these positions should include curriculum vitae, bibliography, and three letters of reference. (Instructorship applications should also include an abstract of the thesis and either a list of graduate courses completed or a transcript of graduate work.) Visiting faculty applications should indicate the portion of the three quarter academic year during which the applicant wishes to visit. Please send your application to Committee on Staffing, Department of Mathematics, 233 JWB, University of Utah, Salt Lake City, Utah 84112. The University of Utah is an Equal Opportunity, Affirmative Action Employer and encourages applications from women and minorities, and provides reasonable accommodation to the known disabilities of applicants and employees.

WISCONSIN

UNIVERSITY OF WISCONSIN-MADISON

The Department of Mathematics invites applications for up to three faculty positions at the tenure-track or early tenured level to begin August 1995 or later. Preference will be given to the areas of applied mathematics, geometry, and topology. Candidates should exhibit evidence of outstanding research and a strong commitment to excellence in teaching. Applicants should send a completed application cover sheet (as provided on page 577 of the July/August, 1994, *Notices of the AMS*) and a curriculum vita which includes a publication list and a brief statement of research plans to:

Hiring Committee
Dept. of Mathematics, Van Vleck Hall
University of Wisconsin-Madison
480 Lincoln Drive
Madison, WI 53706-1388

Applicants should also arrange to have sent to the above address, three to four letters of recommendation, at least one of which must discuss the applicant's teaching experiences and capabilities. Other evidence of good teaching will be helpful. The deadline for completed applications is November 30, 1994. The University of Wisconsin is an Affirmative Action, Equal Opportunity Employer and welcomes applications from women and minorities. Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

CANADA

Mathematics Department UNIVERSITY OF BRITISH COLUMBIA Vancouver, B.C. Canada, V6T 1Z2

The Mathematics Department is seeking an outstanding candidate for a tenure-track assistant professorship to begin 1 July 1995. Our highest priority is for a candidate in mathematical biology with emphasis in ecology. Applicants should have a proven research record of high quality and have demonstrated interest and ability in teaching. Preference will be given to candidates who have one or more years of postdoctoral experience. This position is subject to final budgetary approval. Appointment may be considered at a higher rank for an exceptionally well-qualified candidate. A joint appointment with one of the life sciences, if appropriate, is a possibility. The salary will be commensurate with experience and research record. Applicants should send a C. V. including list of publications, statement of research and teaching interests, and arrange for three letters of recommendation to be sent directly to:

Professor U. Haussmann, Head
Department of Mathematics
University of British Columbia
#121 - 1984 Mathematics Road
Vancouver, B.C. Canada V6T 1Z2

**Applications must be received before
January 1, 1995.**

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. UBC welcomes all qualified applicants, especially women, aboriginal people, visible minorities, and persons with disabilities.

THE UNIVERSITY OF NEW BRUNSWICK, Fredericton Department of Mathematics and Statistics

invites applications for a tenure-stream position at the assistant professor level, effective July 1, 1995. Candidates are expected to have a Ph.D. in pure or applied mathematics or in statistics and to have a commitment to teaching and research. The field of expertise is largely open, subject to the criterion that preference will be given to candidates whose expertise could enable them to collaborate on research with at least one current member of the department. Salary will depend on the candidate's qualifications.

In accordance with Canadian immigration requirement, this advertisement is directed to Canadian citizens and permanent residents of Canada. The University of New Brunswick is committed to the principle of employment equity.

Applications together with CV and the names of three referees should be sent to:

Dr. Jon Thompson, Chair
Department of Mathematics & Statistics
University of New Brunswick
P. O. Box 4400
Fredericton, N.B.
E3B 5A3
e-mail: jon@math.unb.ca

The deadline for receipt of applications is November 15, 1994.

UNIVERSITY OF TORONTO Department of Mathematics

The department solicits applications for a tenure-stream appointment in geometric analysis.

The appointment is at the downtown (St. George) campus at the level of assistant professor, to begin July 1, 1995. Candidates are expected to have at least three years experience in teaching and research after the Ph.D., and to be able to demonstrate excellence in each. In particular, a candidate's research should show clearly the ability to make significant original and independent contributions to mathematics. Salary commensurate with qualifications.

Applicants should send their complete C. V. including a list of publications, a short statement describing their research programme, and all appropriate material about their teaching. They should also arrange to have at least four letters of reference sent directly to Professor V. Ivrii, associate chair, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1. At least one letter should be primarily concerned with the candidate's teaching. To insure full consideration, this information should be received by January 15, 1995.

In accordance with its Employment Equity Policy, the University of Toronto encourages ap-

plications from qualified women or men, members of visible minorities, aboriginal peoples, and persons with disabilities.

**UNIVERSITY OF TORONTO
Department of Mathematics**

The department solicits applications for a tenure-stream appointment in applied mathematics. Preference will be given to researchers in the areas of applied probability and non-linear partial differential equations.

The appointment is at the downtown (St. George) campus at the level of assistant professor, to begin July 1, 1995. Candidates are expected to have at least three years experience in teaching and research after the Ph.D., and to be able to demonstrate excellence in each. In particular, a candidate's research should show clearly the ability to make significant original and independent contributions to mathematics. Salary commensurate with qualifications.

Applicants should send their complete C. V. including a list of publications, a short statement describing their research programme, and all appropriate material about their teaching. They should also arrange to have at least four letters of reference sent directly to Professor V. Ivrii, associate chair, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1.

At least one letter should be primarily concerned with the candidate's teaching. To insure full consideration, this information should be received by January 15, 1995.

In accordance with its Employment Equity Policy, the University of Toronto encourages applications from qualified women or men, members of visible minorities, aboriginal peoples, and persons with disabilities.

**UNIVERSITY OF TORONTO
Department of Mathematics**

The department solicits applications for one or more limited-term assistant professorships, which may be at the St. George (downtown), Scarborough, or Erindale campus. The positions are for the three-year period July 1, 1995, to June 30, 1998. Duties consist of teaching and research, and candidates must demonstrate

clear strength in both. Preference will be given to candidates with recent doctoral degrees. Salary commensurate with qualifications.

Applicants should send their complete C. V. including a list of publications, a short statement describing their research programme, and all appropriate material about their teaching. They should also arrange to have at least four letters of reference sent directly to Professor V. Ivrii, associate chair, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1. At least one letter should be primarily concerned with the candidate's teaching. To insure full consideration, this information should be received by December 31, 1994.

In accordance with Canadian immigration requirements this advertisement is directed to Canadian citizens and permanent residents of Canada. In accordance with its Employment Equity Policy, the University of Toronto encourages applications from qualified women or men, members of visible minorities, aboriginal peoples, and persons with disabilities.

GERMANY

**GEORG-AUGUST-UNIVERSITY
Göttingen**

The Mathematics faculty of the Georg-August-University of Göttingen has a chair of pure mathematics to be filled in real analysis. (The previous holder of the chair was Prof. Heinz.) Applicants, who are active researchers in the field of real analysis, and who meet the qualifications specified in section 51 of the University of Law of Lower Saxony, should send their applications with a curriculum vitae, résumé of research interests and teaching experience to:

der Dekan des Fachbereichs
Mathematik
Georg-August-University
Bunsenstr. 3-5
D 37073 Göttingen
Germany
e-mail:

tammo@cfgauss.uni-math.gwdg.de
Deadline for applications is October 10, 1994.

PUBLICATIONS FOR SALE

MATH SCI PRESS, 53 Jordan Rd., Brookline, MA 02146; 617-738-0307. **Lie-Theoretic ODE Numerical Analysis, Mechanics and Differential Systems** by Robert Hermann, \$95. In Preparation: **C-O-R Generalized Function Algebras and Current Algebras**.

PUBLICATIONS WANTED

Wanted: Mathematical books, journals, reprints, ephemera. Contact R. K. Dennis, Math. Dept., White Hall, Cornell U., Ithaca, NY 14853-7901. Tel: 607-255-4027, FAX: 607-255-7149. e-mail: dennis@math.cornell.edu

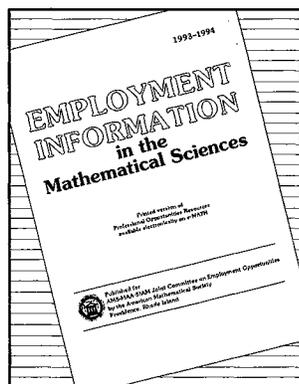
SITUATIONS WANTED

DISTINGUISHED MATHEMATICS PROFESSOR AND RESEARCHER (ALGEBRA, GEOMETRY). Ph.D. 1959, Dr. Sci. 1972. Ninety publications. Founder of "Nonlinear Geometric Algebra". Thirty-five years research and teaching experience in Russia and abroad. Supervisor of sixteen mathematicians earned Ph.D. and Dr. Sci. Lev Sabinin, Varga Street 8, Apt. 12, Moscow, 117133, Russia. Fax: +7(095)9540336.

MATHEMATICIAN, TEACHING AND RESEARCH. Ph.D. 1985. Specialty: differential equations and dynamical systems. Ten published articles. Nine years experience in teaching and academic research. References and résumé available upon request. M. Alwash, 11720 Bellagio Road, #204, Los Angeles, CA 90049.

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Employment Information in the Mathematical Sciences



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e-math.ams.org), electronically by e-MATH, or by mailing to EIMS, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

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MATHEMATICS

BOOKS

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**Topological Theory of Dynamical Systems
Recent Advances**

By **N. Aoki** and **K. Hiraide**

North-Holland Mathematical Library Volume 52

©1994 424 pages Hardbound
Price: Dfl. 225.00 (US\$128.50)
ISBN 0-444-89917-0

This monograph aims to provide an advanced account of some aspects of dynamical systems in the framework of general topology, and is intended for use by interested graduate students and working mathematicians. Although some of the topics discussed are relatively new, others are not: this book is not a collection of research papers, but a textbook to present recent developments of the theory that could be the foundations for future developments. This book contains a new theory developed by the authors to deal with problems occurring in differentiable dynamics that are within the scope of general topology. To follow it, the book provides an adequate foundation for topological theory of dynamical systems, and contains tools which are sufficiently powerful throughout the book.

Graduate students (and some undergraduates) with sufficient knowledge of basic general topology, basic topological dynamics, and basic algebraic topology will find little difficulty in reading this book.

Introduction to Operator Theory and Invariant Subspaces

By **B. Beauzamy**

North-Holland Mathematical Library Volume 42

©1988 xiv + 358 pages Hardbound
Price: Dfl. 193.00 (US\$110.25)
ISBN 0-444-70521-X

This monograph only requires of the reader a basic knowledge of classical analysis: measure theory, analytic functions, Hilbert spaces, functional analysis. The book is self-contained, except for a few technical tools, for which precise references are given. Part I starts with finite-dimensional spaces and general spectral theory. But very soon (Chapter III), new material is presented, leading to new directions for research. Open questions are mentioned here. Part II concerns compactness and its applications, not only spectral theory for compact operators (Invariant Subspaces and Lomonosov's Theorem) but also duality between the space of nuclear operators and the space of all operators on a Hilbert space, a result which is seldom presented. Part III contains Algebra Techniques: Gelfand's Theory, and application to Normal Operators. Here again, directions for research are indicated. Part IV deals with analytic functions, and contains a few new developments. A simplified, operator-oriented, version is presented. Part V presents dilations and extensions: Nagy-Foias dilation theory, and

the author's work about C_1 -contractions. Part VI deals with the Invariant Subspace Problem, with positive results and counter-examples. In general, much new material is presented. On the Invariant Subspace Problem, the level of research is reached, both in the positive and negative directions.

Solution of Continuous Nonlinear PDEs through Order Completion

By **M.B. Oberguggenberger** and **E.E. Rosinger**

North-Holland Mathematics Studies Volume 181

©1994 448 pages Hardbound
Price: Dfl. 250.00 (US\$143.00)
ISBN 0-444-82035-3

This work inaugurates a *new* and *general* solution method for *arbitrary continuous nonlinear PDEs*. The solution method is based on Dedekind *order completion* of usual spaces of smooth functions defined on domains in Euclidean spaces. However, the nonlinear PDEs dealt with need *not* satisfy any kind of monotonicity properties. Moreover, the solution method is completely *type independent*. In other words, it does not assume anything about the nonlinear PDEs, except for the *continuity* of their left hand term, which includes the unknown function. Furthermore the right hand term of such nonlinear PDEs can in fact be given any *discontinuous* and *measurable* function.

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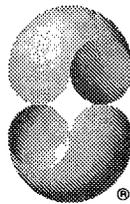
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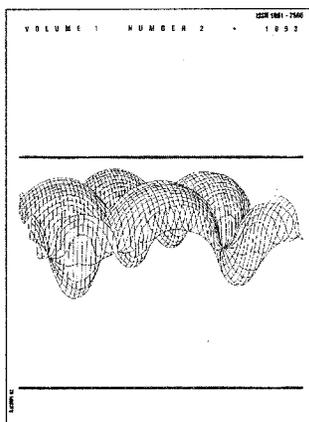
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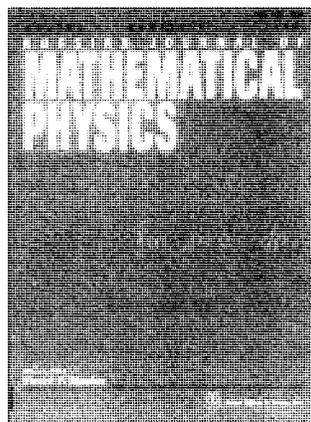
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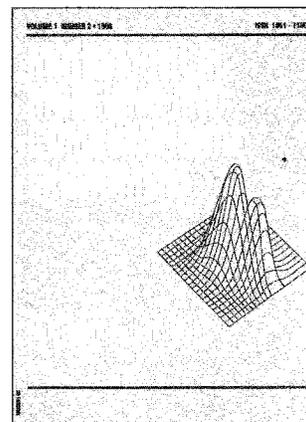
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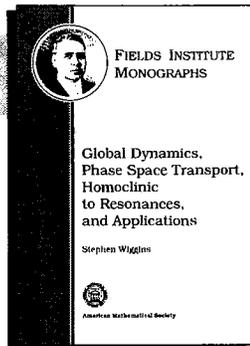
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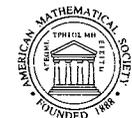
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Publications, videotapes, and miscellaneous items are sent via UPS to U.S. residential addresses, RPS or UPS to U.S. business addresses, and as printed matter elsewhere unless another delivery method is requested. Charges for surface delivery are paid by the AMS. For air delivery outside the U.S., please include an additional \$6.50 per item. **Software** is sent via UPS Second Day Air to U.S. addresses and via U.S. Postal Service air parcel post to addresses outside the United States. Add shipping and handling for software: \$8 per order in the U.S. and Canada; outside the U.S. and Canada \$35 per order (\$15 per order for AMS-TeX and/or AMSFonts only). **Journal back numbers, Mathematical Reviews** indexes, and review volumes are sent via surface mail to any destination unless air delivery is requested. Postage for surface mail is paid by the AMS. Air delivery rates, which will be quoted upon request, must be paid by the purchaser.

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Change of Address

Members of the Society who move or who change positions are urged to notify the Providence Office as soon as possible.

Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the *Combined Membership List*). In addition, the AMS maintains records of members' honors, awards,

and information on Society service. Information of the latter kind appears regularly in *Notices*.

When changing their addresses, members are urged to cooperate by supplying the information requested below. The Society's records are of value only to the extent that they are current and accurate.

If your address has changed or will change within the next two or three months, please fill out this form, supply any other information appropriate for the AMS records, and mail to the address given below.

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Joint Mathematics Meetings Advance Registration/Housing Form

San Francisco, CA • January 4-7, 1995

Please complete this form and return it with your payment to: Mathematics Meetings Service Bureau (MMSB), P. O. Box 6887,
Providence, RI 02940; Telephone: (401) 455-4143

DEADLINES:

Room Lottery, Registration Material Mailed in December	November 9, 1994
Hotel Reservations, Advance Ticket Sales, Employment Register	November 16, 1994
Housing Changes and Cancellations	December 1, 1994
Advance Registration for Joint Meetings and AMS Short Course	December 7, 1994
50% Refund on Tickets	December 23, 1994 (no refunds after this date)
50% Refund on Advance Registration, Employment Register, AMS Short Course	December 30, 1994 (no refunds after this date)

(N. B.: A separate form appears in this issue for advance registration for MAA Minicourses)

ADVANCE REGISTRATION SECTION: Please complete this section and the appropriate sections on the reverse.

Name: _____ Telephone: _____
(please print) Surname First Middle

(mailing address)

(mailing address continued) (e-mail address)

Company/University (for badge): _____

Names for Guest Badges: _____

I do not wish my badge, tickets, program, and/or Employment Register material to be mailed; however, the mailing address for my acknowledgment and room confirmation is given above.

JOINT MATHEMATICS MEETINGS

- Member of AMS, ASL, CMS, MAA \$130
- Nonmembers \$202
- Graduate Student \$35
- Undergraduate Student \$20
- High School Student \$2
- Unemployed \$35
- Temporarily Employed \$95
- Third World Fee \$35
- Emeritus Member of AMS or MAA \$35
- High School Teacher \$35
- Librarian \$35
- Exhibitor \$0

MEMBERSHIP

- AMS MAA CMS ASL
- AWM NAM MR field of interest _____

EMPLOYMENT REGISTER

- Employer (1st interviewer) \$150
- Employer (2nd or 3rd interviewer) \$75
- Applicant \$35
- Posting job descriptions \$50

AMS SHORT COURSE

- Member/Nonmember \$75
- Student/Unemployed/Emeritus \$30

Title of Short Course: _____

TICKETS

- _____ AMS Banquet @ \$40 each = \$ _____ Veg Kosher
- _____ MER Banquet @ \$45 each = \$ _____ Veg Kosher
- _____ NAM Banquet @ \$40 each = \$ _____ Veg Kosher
- _____ Museum Tour @ \$26 each = \$ _____

HOTEL DEPOSIT BY CHECK \$ _____

STUDENTS ONLY:

- I plan to attend the Mathchats
- I plan to attend the MAA Student Workshop

TOTAL AMOUNT ENCLOSED: \$ _____ Method of Payment: Check (payable to AMS); Canadian checks must be marked "U. S. Funds"
 Institutional Purchase Order (attached) VISA or MasterCard

Card Number: _____ Exp. date: _____

Name on Card: _____
(printed name) (signature of cardholder)

Codes	Options	Hotel	Room Type
Dates	Hotel Deposit	Total Amount Paid	
Special Remarks			

HOUSING SECTION:

I will not require housing. I am making my own arrangements. I am staying in private accommodations. I am requesting a hotel reservation below.

Please rank hotels in order of preference by writing 1, 2, 3, etc., in the spaces at the left on the form and by circling the requested room type and rate. If the rate or hotel requested is no longer available, you will be assigned a room at a ranked or unranked hotel at a comparable rate. Rates listed below are subject to 12% sales/occupancy tax. **GUARANTEE REQUIREMENTS:** First night deposit by check OR a credit card guarantee with VISA, MasterCard, or American Express. Please supply this information on the reverse.

Order of choice	Room Category	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites (starting rates)	
	Hilton and Towers (Headquarters)	DELUXE	\$ 115	\$ 128	\$ 128	\$ 148	N/A	\$ 168	N/A	\$ 300
		SUPERIOR	103	115	115	135	N/A	155	N/A	300
		REGULAR	90	102	102	123	N/A	143	N/A	300
		STUDENT	78	78	78	N/A	N/A	N/A	N/A	300
	The Parc Fifty Five	REGULAR	92	92	92	107	\$ 107	122	\$ 122	289
	The Handlery Union Square	REGULAR	83	83	83	93	N/A	103	N/A	153
		STUDENT	73	73	73	83	N/A	93	N/A	153
	Holiday Inn Golden Gateway (ASL sessions)	REGULAR	82	82	82	97	107	112	122	250
		STUDENT	73	73	73	88	98	103	113	250
	The King George Hotel	REGULAR	78	78	78	N/A	N/A	N/A	N/A	N/A
		STUDENT	68	68	68	N/A	N/A	N/A	N/A	N/A
	The Orchard	REGULAR	78	78	78	88	98	N/A	N/A	175
	The Raphael	REGULAR	73	78	78	N/A	88	N/A	N/A	N/A
		STUDENT	63	73	73	N/A	83	N/A	N/A	N/A
	Chancellor Hotel	REGULAR	72	72	72	N/A	87	N/A	N/A	N/A
		STUDENT	62	62	62	N/A	77	N/A	N/A	N/A
	Ramada Inn	REGULAR	72	72	72	84	96	N/A	N/A	N/A
		STUDENT	62	62	62	74	86	N/A	N/A	N/A
	Howard Johnson Pickwick	REGULAR	68	N/A	68	80	92	92	104	179
		STUDENT	62	N/A	62	74	86	86	98	179
	Hotel Californian	REGULAR	63	63	63	73	73	83	N/A	93

Special housing requests/needs _____

I will arrive on (date) _____ at _____ a.m./p.m., and depart on (date) _____ at _____ a.m./p.m.

Please list other room occupants, indicating their full name, arrival, and departure dates, and ages of children, and check here if one of the occupants is your spouse.

MAA Minicourse Advance Registration Form, San Francisco, California

January 4–7, 1995

Note: This is NOT the AMS Short Course Form. Please use the Joint Meetings Advance Registration/Housing Form to register in advance for the AMS Short Course.

To register for MAA Minicourse(s), please complete THIS FORM or a PHOTOCOPY OF THIS FORM and return with your payment to:

Minicourse Coordinator
Mathematical Association of America
1529 Eighteenth Street N. W.
Washington, DC 20036
Telephone: 202-387-5200, 800-331-1622

 Telephone: _____
 (Please print) Surname First Middle

 Street Address City State Zip

- **Deadline for MAA Minicourse Advance Registration:** November 16, 1994 (After this date, potential participants are encouraged to call the MAA headquarters at 800-331-1622 for availability of minicourses.)
- **Deadline for cancellation in order to receive a 50% refund:** December 30, 1994
- Each participant must fill out a separate Minicourse Advance Registration Form.
- Enrollment is limited to two minicourses, subject to availability.

Please complete the following:

I would like to attend 1 Minicourse 2 Minicourses
 Please enroll me in MAA Minicourse(s): # _____ and # _____
 In order of preference, my alternatives are: # _____ and # _____

• **PAYMENT**

Check enclosed: \$ _____ Credit Card type: Mastercard Visa
 Credit card # _____ Expiration date: _____
 Signature: _____

Minicourse

1. Calculus from graphical, numerical, and symbolic points of view *
2. Teaching environmental numeracy to liberal arts students *
3. Combinatorics via functional equations *
4. The mathematics of epidemics *
5. An introductory mathematics course called Chance
6. Exploring MathKit microworlds
7. How to use graphing calculator-based numerical and graphical methods, etc.
8. Learning-styles approach to mathematics instruction
9. Dynamic geometry via *Geometer's Sketchpad*
10. The use of symbolic computation in probability & statistics
11. Multivariable calculus using the Harvard Calculus Consortium Materials
12. Linear algebra with *DERIVE*
13. Introduction to research in the teaching and learning of undergraduate mathematics, etc.
14. Recovering motivation in mathematics: Teaching with original sources
15. Cooperative groups and Socratic interactions in the college mathematics classroom
16. How to make fractals
17. An introduction to numerical modeling
18. Calculus in context
19. An introduction to fractal functions and fractal surfaces / wavelet theory
20. Doing discrete mathematics with undergraduates
21. Mathematical modeling
22. Learning about today's job market for mathematics Ph.D.s *

Organized by:

A. Ostebee & P. Zorn	\$45
M. Walter	\$45
D. Snow	\$45
S. Sandberg	\$45
J. L. Snell, P. Doyle, & J. Garfield	\$45
L. Geissinger & J. White	\$65
W. Ellis, Jr. & B. Waits	\$45
K. Williamson & R. Schori	\$45
D. Schattschneider & J. King	\$65
Z. A. Karian & E. A. Tanis	\$65
T. Tucker	\$45
J. Johnson & B. Evans	\$65
J. Ferrini-Mundy & M. Kathleen Heid	\$45
R. Laubenbacher & D. Pengelley	\$45
W. J. Davis & T. Ralley	\$45
D. Gulick & J. Scott	\$45
J. Loase & B. A. Fusaro	\$45
J. Callahan, K. Hoffman, D. O'Shea, & H. Pollatsek	\$65
P. R. Massopust	\$45
G. J. Sherman	\$45
M. Meerschaert	\$45
C. Bennett & R. Phillips	\$20

* Note: Minicourses #1–4 and #22 are on Tuesday, January 3.

MAA MINICOURSES

Minicourse 1: *Calculus from Graphical, Numerical, and Symbolic Points of View*, Arnold Ostebee and Paul Zorn, St. Olaf College. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 50. This minicourse introduces *Calculus from Graphical, Numerical, and Symbolic Points of View*, a calculus text developed at St. Olaf College with support from the NSF and FIPSE. The text complements the standard symbolic/algebraic approach to calculus with pervasive and systematic treatment of geometric and numerical points of view. Technology is used to foster and facilitate graphical and numerical thinking. This minicourse will include brief overviews of philosophy, pedagogy, and mathematical content; hands-on work on textbook problems; group discussion and critique; practical advice; and reports from experienced field testers. Participants will be supplied copies of the text. Graphing calculators will be available on site; participants are encouraged to bring their own.

Minicourse 2: *Teaching Environmental Numeracy to Liberal Arts Students*, Martin Walter, University of Colorado. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. The goal of the course is to equip students with the mathematical tools they need to understand our increasingly complex environment and thrive in it. Starting with arithmetic we build the mathematical structures that we need. For example, when we study population dynamics we begin our analysis with a Schwartz model, which uses only arithmetic; and we build our way up to exponentials and logarithms. When we are done we are capable of seeing, for example, how family size affects the doubling time of a population. We study some of the mathematics of acid rain, AIDS, ancient forests, fish and materials consumption.

Minicourse 3: *Combinatorics via Functional Equations*, Donald R. Snow, Brigham Young University. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. We will show that many of the ad hoc methods of combinatorics can be unified by a simple functional equations approach. This approach yields the sums of powers of the integers (and many generalizations), combinations and permutations (with many types of repetitions), and other standard combinatorial functions, as well as many new results. This method uses the combinatorial description to find a functional equation and then finds the function from that. It gives a means of getting many of the identities, properties, and generating functions, and shows how the functions are related to each other. Spinoffs from the basic approach include the Bernoulli and Euler polynomials, orthogonal polynomials, and other special functions. An understanding of basic combinatorics, calculus, and power series is sufficient background for this minicourse. The small amount of functional equations needed will be developed in the course.

Minicourse 4: *The Mathematics of Epidemics*, Sonja Sandberg, Framingham State College. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. This minicourse will discuss the many ways that mathematics has been and can be used to describe the behavior of epidemics and infectious diseases. Examples of models appropriate for undergraduate mathematics courses, such as probability and statistics, differential equations, finite mathematics, and mathematical modeling will be presented. The history of quantitative descriptions of epidemic trends will be covered using malaria as an example. Focusing on AIDS, models for risk to an individual, population models for predicting future trends, and the utility of mandatory premarital screening for the AIDS virus will be discussed.

Minicourse 5: *An Introductory Mathematics Course Called Chance*, J. Laurie Snell, Dartmouth College, Peter Doyle, University of California, San Diego, and Joan Garfield, University of Minnesota. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 2:15 p.m. to 4:15 p.m. on Wednesday. Enrollment limited to 80. CHANCE is a case study course that deals with current news involving probability or statistical concepts. It is being developed with NSF support. This minicourse will show how we teach CHANCE. We will start with small group discussions of a current news article. This will be followed by a general discussion of the probabilistic and statistical issues involved. The use of activities, computer simulations, and Mosaic on the Internet will be illustrated. There are no prerequisites.

Minicourse 6: *Exploring MathKit Microworlds*, Ladnor Geissinger and Jim White, University of North Carolina - Chapel Hill. Part A: 8:00 a.m. to 10:00 a.m. on Saturday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 30. As a reader turns the "pages" of a MathKit book, exploratory math microworlds are

created. The book is a computer document and the pages may contain text, calculations, symbolic expressions, 2- & 3-D graph windows, animations, and code to be executed. Readers can read the text, observe an animation, use built-in tools to explore math topics, write a report, and program. The presenters will use the Windows toolbox MathKit, and MathWright, a simple authoring system designed to make it easy for teachers to construct learning environments. We will lead participants through a variety of sample books, most written by teachers at IMTP workshops, and together we'll try the authoring tools to see how one builds a book. A brief description of MathKit books, objects and basic commands will be handed out. Participants should have used at least one Windows application.

Minicourse 7: *How to Use Graphing Calculator-Based Numerical and Graphical Methods to Enhance the Teaching and Learning of Calculus*, Wade Ellis, Jr., West Valley College, and Bert Waits, The Ohio State University. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 8:00 a.m. to 10:00 a.m. on Thursday. Enrollment limited to 30. Participants will have the opportunity to gain "hands-on" experience using graphing calculator-based graphical and numerical methods with selected topics from differential and integral calculus. Our focus will be on how the teaching and learning of calculus changes when graphing calculators are readily available to calculus students for both classroom and homework activities. Topics will include limits, derivatives, optimization, differential equations, integration and related applications. Graphing calculators will be provided for each participant, who is expected to have had some experience with graphing calculators.

Minicourse 8: *Learning-Styles Approach to Mathematics Instruction*, Kenneth Williamson and Richard Schori, Oregon State University. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 2:15 p.m. to 4:15 p.m. on Thursday. Enrollment limited to 80. The workshop 1) introduces a methodology for planning courses that increases student understanding, retention, and satisfaction, and 2) sensitizes faculty to the different learning styles of students which motivates the importance of 1). The methodology, termed the Integrated Learning Cycle, allows flexibility for faculty to alternately incorporate displays of mathematics (symbolically, numerically, and graphically), practice in laboratory situations, and real world applications. Examples will be given of learning cycles used for various math concepts in calculus and each participant will apply the learning cycle to one of his/her courses.

Minicourse 9: *Dynamic Geometry via Geometer's Sketchpad*, Doris Schattschneider, Moravian College, and James King, University of Washington. Part A: 2:15 p.m. to 4:15 p.m. on Wednesday, and Part B: 2:15 p.m. to 4:15 p.m. on Thursday. Enrollment limited to 30. *The Geometer's Sketchpad* is one of a new breed of programs that allow one to sketch (or construct) two-dimensional figures (without equations) and manipulate them interactively in real time to discover invariant properties, view loci, measure and compare, transform by isometries and similarities, investigate non-Euclidean figures, and even discover theorems. Participants will learn the basics of the program and see specific examples of how it can be used in various undergraduate college courses, including those that prepare students to teach mathematics in high school. The instructors will lead participants through two tutorials: Constructions and Transformations. In both sessions, participants will be made aware of demonstration sketches and scripts as well as other resources that are available.

Minicourse 10: *The Use of Symbolic Computation in Probability and Statistics*, Zaven A. Karian, Denison University, and Elliot A. Tanis, Hope College. Part A: 8:00 a.m. to 10:00 a.m. Friday, and Part B: 1:00 p.m. to 3:00 p.m. on Friday. Enrollment limited to 30. This minicourse will show how a comprehensive package of about 100 *Maple* procedures, made available by the authors, can enhance advanced undergraduate courses in probability and statistics. Specific laboratory problems will illustrate the effective instructional use of simulations that require the generation of random samples from certain distributions (or from specified sampling distributions). The course will have a significant hands-on component and participants are expected to be familiar with the use of microcomputers. Although useful, prior experience with *Maple* is not necessary.

Minicourse 11: *Multivariable Calculus Using the Harvard Calculus Consortium Materials*, Thomas W. Tucker, Colgate University. Part A: 2:15 p.m. to 4:15 p.m. on Thursday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 50. The NSF-supported Harvard Calculus Consortium has completed a textbook on single variable and is working on materials for a multivariable course. These materials have been used at a number of institutions. The presenters will give the

participants an overview of those materials and their implementation, as well as direct experience with selected portions of the course. Participants will have the opportunity to work in groups on exercises from the text and discuss the pedagogical implications. The team of presenters will include members of the Harvard Calculus Consortium working group.

Minicourse 12: *Linear Algebra with DERIVE*, Jerry Johnson, University of Nevada, Reno, and Benny Evans, Oklahoma State University. Part A: 7:00 p.m. to 9:00 p.m. on Thursday, and Part B: 7:00 p.m. to 9:00 p.m. on Friday. Enrollment limited to 30. This minicourse entails hands-on use of the popular software *DERIVE* (for IBM compatible microcomputers). We will introduce novices to *DERIVE* and then examine ways to use it as a demonstration and laboratory tool in elementary linear algebra. This minicourse is concerned far more with novel ideas for using *DERIVE* to enhance student learning of linear algebra than just doing rote calculations. Copies of the presenters' book *Exploring Linear Algebra with DERIVE* will be made available for participants to use during the minicourse. It will be our main source of examples.

Minicourse 13: *Introduction to Research in the Teaching and Learning of Undergraduate Mathematics: Examples in Calculus*, Joan Ferrini-Mundy, University of New Hampshire, and M. Kathleen Heid, Pennsylvania State University. Part A: 7:00 p.m. to 9:00 p.m. Thursday, and Part B: 8:00 a.m. to 10:00 a.m. Saturday. Enrollment limited to 30. Can better understanding of how students learn, and of how teaching affects learning, lead to more effective undergraduate mathematics experiences? We will encourage the formation of working groups interested in pursuing this question. By viewing data from research studies of learning and teaching in calculus and other areas, and by conducting clinical interviews with undergraduate students, participants will gain first-hand introductory experience with qualitative research methods. An overview of literature and resources helpful for those interested in "getting started" in research of this nature will be provided. "Homework" between sessions is planned.

Minicourse 14: *Recovering Motivation in Mathematics: Teaching with Original Sources*, Reinhard Laubenbacher and David Pengelley, New Mexico State University. Part A: 8:00 a.m. to 10:00 a.m. on Friday, and 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 80. Mathematics education is faced with two important problems: lack of motivation in the presentation of theories, and overemphasis of utility at the expense of creativity. Participants will explore how the study of a problem at a subject's core and the long road toward its solution, through reading original historical sources, can be an effective remedy for both these problems. This method can be successful either in specially designed courses or in the existing curriculum. Original source materials will be provided, with special focus on a lower division course illustrating the development of five branches of mathematics.

Minicourse 15: *Cooperative Groups and Socratic Interactions in the College Mathematics Classroom*, William J. Davis and Thomas Ralley, The Ohio State University. Part A: 8:00 a.m. to 10:00 a.m. on Friday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 60. Teaching calculus in a laboratory setting provides many new insights into students' learning processes. Getting students involved with mathematics is the central issue. Getting students to work together, to discuss and debate, and verbalize their ideas is a most important step. Well-designed problem sets and Socratic responses to student questions leave the way open for students to draw correct conclusions, justify them, and assume ownership of their new ideas. This course will actively engage participants in such experiences through selected examples.

Minicourse 16: *How to Make Fractals*, Denny Gulick, University of Maryland, and Jon Scott, Montgomery College. Part A: 8:00 a.m. to 10:00 a.m. on Friday, and Part B: 1:00 p.m. to 3:00 p.m. on Saturday. Enrollment limited to 40. Twenty years after Mandelbrot coined the term "fractal", this minicourse will focus on fractals created on the computer or calculator screen and the mathematics behind them. During the first session the relevant mathematics (including Hausdorff distance, affine maps, unions of functions, and the Contraction Mapping Theorem) will be presented. During the second session participants will create fractals on graphing calculators, which will be provided for their use. There will also be a demonstration of the Macintosh program Fractal Attraction. There are no mathematical or computer prerequisites; handouts will include pertinent information.

Minicourse 17: *An Introduction to Numerical Modeling*, John Loase, Westchester Community College, and Ben A. Fusaro, Salisbury State University. Part A: 1:00 p.m. to 3:00 p.m. on Friday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. This minicourse will give participants the necessary materials and suggestions to innovate either a mathematical modeling team or a

modeling course. The minicourse will feature: 1) presentations by students who won the International Contest in Modeling; 2) a presentation by Ben Fusaro to assist faculty with practical suggestions on forming a modeling team; 3) distribution and discussion of a 250+ page Modeling Manual, which is the outgrowth of Loase's National Science Foundation Grant.

Minicourse 18: *Calculus in Context*, James Callahan, Smith College, Kenneth Hoffman, Hampshire College, Donal O'Shea, Mount Holyoke College, and Harriet Pollatsek, Mount Holyoke College. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 8:00 a.m. to 10:00 a.m. on Thursday. Enrollment limited to 30. Calculus in Context was the first large curriculum project funded under the NSF Calculus Reform initiative. It focuses on differential equations from the outset, draws mathematical concepts out of scientific problems, and uses computers (or graphing calculators) extensively at every stage for graphical and numerical analysis. Minicourse participants will experience what students do by discussing contextual problems, creating differential equations to model them, and analyzing those models using computers. Previous computer experience is not necessary.

Minicourse 19: *An Introduction to Fractal Functions and Fractal Surfaces and their Connection to Wavelet Theory*, Peter R. Massopust, Sam Houston State University. Part A: 7:00 p.m. to 9:00 p.m. on Friday, and 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. This minicourse introduces the fundamentals of the theory of fractal functions and surfaces and shows their connection to wavelets. The fractal point of view not only unifies the seemingly different classical examples of nowhere differentiable functions but also provides further insight into the fine structure of functions and surfaces. Throughout the course the participant is exposed to topics and exercises that usually go beyond undergraduate calculus and analysis but which are nevertheless at the heart of the subject matter and which can easily be implemented into an existing curriculum to provide a well-rounded perspective. The course material is taken from the presenter's monograph on Fractal Functions, Fractal Surfaces and Wavelets but is presented at a level that is accessible to the non-expert.

Minicourse 20: *Doing Discrete Mathematics with Undergraduates*, Gary J. Sherman, Rose-Hulman Institute of Technology. Part A: 8:00 a.m. to 10:00 a.m. on Saturday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. Rose-Hulman's NSF Research Experience for Undergraduates program has produced a process (getting the question, computer experimentation, interaction, collaboration, conjecturing, writing) which is now an integral and well-received component of the presenter's discrete mathematics and abstract algebra courses. Minicourse participants will experience (as students) the process by working through a (condensed) version of a research project that has been adapted for an academic year course. Additional examples will be discussed and participants will be encouraged to develop their own projects. Handouts will be provided from *Indiscrete Discrete Mathematics and Experiments in Finite Group Theory*. Participants and their students are expected to have access to at least one of *Axiom*, *GAP*, *Macaulay*, *Magma*, *Maple*, or *Mathematica*.

Minicourse 21: *Mathematical Modeling*, Mark M. Meerschaert, University of Nevada. Part A: 7:00 p.m. to 9:00 p.m. on Friday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment limited to 80. In this minicourse, we will introduce a general five-step method for mathematical modeling. Participants will apply the method, working in small groups to solve several real world modeling problems in the areas of optimization, dynamical systems, and stochastic processes. Discussions will include consideration of appropriate technologies (graphing calculators, computer algebra systems, spreadsheets, computer simulation) and their use in the classroom. Specific examples to demonstrate the appropriate use of several different technologies will be presented, and handouts will be distributed containing actual computer outputs. Participants will also be invited to share their own relevant classroom experience. The five-step method and the problem descriptions used in this minicourse are taken from the presenter's textbook, *Mathematical Modeling*.

Minicourse 22: *Learning About Today's Job Market for Mathematics Ph.D.s*, Curtis D. Bennett, Bowling Green State University, and Richard Phillips, Michigan State University. Part A: 3:00 p.m. to 5:00 p.m. on Tuesday, and Part B: 7:00 p.m. to 9:00 p.m. on Tuesday. Enrollment limited to 80. This is a course on the current academic and industrial job market. The target audience is graduate students, Ph.D. advisors, AND graduate chairs. The purpose of this course is to provide information on what employers are looking for in a candidate, how best for a student to prepare for different jobs, and how best to apply for jobs. We will discuss the academic, the industrial, and the government job markets.

Instructions for Applicant and Employer Forms

Applicant forms submitted for the Employment Register by the November 16 deadline will be photographically reproduced in a booklet titled *Winter List of Applicants*.

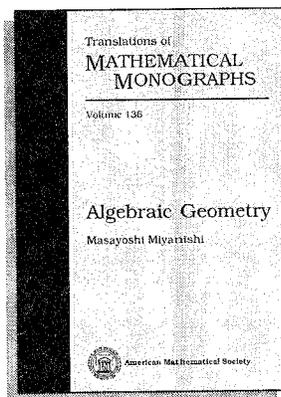
Employer forms submitted by the November 16 deadline will be photographically reproduced for the *Winter List of Employers*. Employers are encouraged to provide more than one interviewer when they are able to do so in order to increase the number of interviews which may be scheduled. Please take care to indicate the number of interviewers for whom simultaneous interviews may be scheduled. Please refer to the Employment Register text for specific instructions.

The forms must be carefully typed. Do not erase—it causes smudges which reproduce when photographed. Use a correcting typewriter or correction tape or fluid if necessary. Submit the original typed version only. Copies will not reproduce properly and are not acceptable. **Hand-lettered forms will be returned. Do not type outside the box.**

All forms must be received by the Society by November 16, 1994, in order to appear in the *Winter Lists*. If you are attending the meeting, the Advance Registration/Housing Form printed in this issue must accompany the form.

1991 Mathematics Subject Classification

- | | | | |
|----|---|----|---|
| 00 | General | 44 | Integral transforms, operational calculus |
| 01 | History and biography | 45 | Integral equations |
| 03 | Logic and foundations | 46 | Functional analysis |
| 04 | Set theory | 47 | Operator theory |
| 05 | Combinatorics | 49 | Calculus of variations, optimal control |
| 06 | Order, lattices, ordered algebraic structures | 51 | Geometry |
| 08 | General mathematical systems | 52 | Convex and discrete geometry |
| 11 | Number theory | 53 | Differential geometry |
| 12 | Field theory and polynomials | 54 | General topology |
| 13 | Commutative rings and algebras | 55 | Algebraic topology |
| 14 | Algebraic geometry | 57 | Manifolds and cell complexes |
| 15 | Linear and multilinear algebra, matrix theory | 58 | Global analysis, analysis on manifolds |
| 16 | Associative rings and algebras | 60 | Probability theory and stochastic processes |
| 17 | Nonassociative rings and algebras | 62 | Statistics |
| 18 | Category theory, homological algebra | 65 | Numerical analysis |
| 19 | K-theory | 68 | Computer science |
| 20 | Group theory and generalizations | 70 | Mechanics of particles and systems |
| 22 | Topological groups, Lie groups | 73 | Mechanics of solids |
| 26 | Real functions | 76 | Fluid mechanics |
| 28 | Measure and integration | 78 | Optics, electromagnetic theory |
| 30 | Functions of a complex variable | 80 | Classical thermodynamics, heat transfer |
| 31 | Potential theory | 81 | Quantum theory |
| 32 | Several complex variables and analytic spaces | 82 | Statistical mechanics, structure of matter |
| 33 | Special functions | 83 | Relativity and gravitational theory |
| 34 | Ordinary differential equations | 85 | Astronomy and astrophysics |
| 35 | Partial differential equations | 86 | Geophysics |
| 39 | Finite differences and functional equations | 90 | Economics, operations research, programming, games |
| 40 | Sequences, series, summability | 92 | Biology and other natural sciences, behavioral sciences |
| 41 | Approximations and expansions | 93 | Systems theory, control |
| 42 | Fourier analysis | 94 | Information and communication, circuits |
| 43 | Abstract harmonic analysis | | |



Algebraic Geometry

Masayoshi Miyanishi
Volume 136

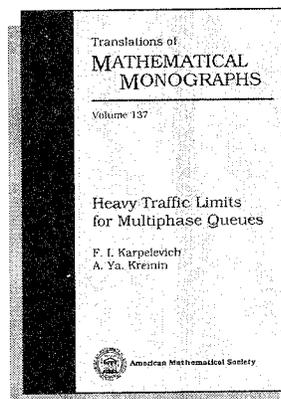
This book, aimed at senior undergraduates and graduate students, grew out of Miyanishi's attempt to lead students to an understanding of algebraic surfaces while presenting the necessary background along the way. Originally published in the Japanese in 1990, it presents a self-contained introduction to the fundamentals of algebraic geometry. This book begins with background on commutative algebras, sheaf theory, and related cohomology theory. The next part introduces schemes and algebraic varieties, the basic language of algebraic geometry. The last section brings readers to a point at which they can start to learn about the classification of algebraic surfaces.

1991 *Mathematics Subject Classification*: 14; 13

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Heavy Traffic Limits for Multiphase Queues

F. I. Karpelevich and A. Ya. Kreinin
Volume 137

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1991 *Mathematics Subject Classification*: 60, 90

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EMPLOYER FORM

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 4-6, 1995
SAN FRANCISCO, CALIFORNIA

1. Form must be typed. (Please see instructions on page facing Applicant Form. No other format will be accepted. Use of MR classification codes is optional.)
2. This form CANNOT be submitted by electronic mail.
3. Hand-lettered forms will be returned. Do not type beyond the box.
4. Please check if Advance Registration/Housing Form previously sent.
5. Return form with payment with your Advance Registration/Housing Form by November 16 to AMS, P.O. Box 6887, Providence, RI 02940, in order to be included in the *Winter List of Employers*.

EMPLOYER
CODE: Institution _____
Department _____
City, State, Zip _____
E-mail address _____

Name(s) of Interviewer(s) 1. _____
2. _____
3. _____
4. _____

Specialties sought _____
(use MR classification codes if possible)

Title(s) of position(s) _____

Number of positions _____

Starting date _____ / _____ Term of appointment _____
Month Year Month Year

Renewal Possible Impossible Tenure-track position Yes No Teaching hours per week _____

Degree preferred _____ Degree accepted _____

Duties _____

Experience preferred _____

Significant other requirements, needs, or restrictions which will influence hiring decisions _____

Able to hire for this position : U.S. Citizen Non-U.S. Citizen, Permanent Resident
(check all that apply) Non-U.S. Citizen, Temporary Resident

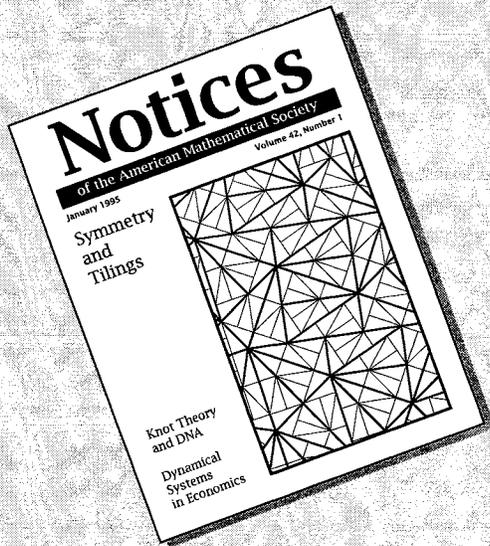
Available for interviews Session 1 (Thurs. AM, 8:15-11:40) Session 2 (Thurs. PM, 1:00-4:40)
 Session 3 (Fri. AM, 8:15-11:40) Session 4 (Fri. PM, 1:00-4:40)

Number of interviewers Session 1: _____ Interviewers Session 2: _____ Interviewers
Session 3: _____ Interviewers Session 4: _____ Interviewers

Not Interviewing

Notices

of the American Mathematical Society



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J.-M. Morel, Université Paris-Dauphine &
S. Solimini, Università degli Studi di Lecce

This book contains a synthesis and a mathematical analysis of a wide set of algorithms and theories whose aim is the automatic segmentation of digital images as well as the understanding of visual perception. Several image processing experiments and many figures illustrate algorithmic discussions and mathematical proofs. The material will be accessible to graduate science students with some mathematical background.

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E. Engeler, ETH, Zurich with collaboration of
K. Aberer, B. Amrhein, O. Gloor, M. von
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Weibel

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A. Lubotzky, Institute of Mathematics,
Hebrew University, Jerusalem, Israel ;
Appendix by J.D. Rogawski

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