

# NOTICES

OF THE

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## 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 of the Mathematical Association of America and the American Mathematical Society. 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. Abstracts

should be submitted on special forms which are available in many departments of mathematics and from the headquarters office of the Society. 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
886	† October 22–23, 1993	College Station, Texas	Expired	October
887	† November 6–7, 1993	Claremont, California	Expired	October
888	† December 1–4, 1993 (Joint Meeting with the Sociedad Matematica Mexicana)	Merida, Yucatan, Mexico	Expired	November
889	* January 12–15, 1994 (100th Annual Meeting)	Cincinnati, Ohio	October 1	December
890	* March 18–19, 1994	Lexington, Kentucky	December 28	March
891	* March 25–26, 1994	Manhattan, Kansas	December 28	March
892	* April 8–10, 1994	Brooklyn, New York	January 28	April
893	June 16–18, 1994	Eugene, Oregon	April 4	May-June
894	August 15–17, 1994 (97th Summer Meeting)	Minneapolis, Minnesota	May 17	July-August
	October 28–29, 1994	Stillwater, Oklahoma	August 3	October
	November 11–13, 1994	Richmond, Virginia	August 3	October
	January 4–7, 1995 (101st Annual Meeting)	San Francisco, California	October 1	December
	March 4–5, 1995	Hartford, Connecticut		
	March 17–18, 1995	Orlando, Florida		
	March 24–25, 1995	Chicago, Illinois		
	November 3–4, 1995	Kent, Ohio		
	January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		
	March 22–23, 1996	Iowa City, Iowa		
	April 19–21, 1996	Baton Rouge, Louisiana		
	January 8–11, 1997 (103rd Annual Meeting)	San Diego, California		

\* Please refer to page 1078 for listing of Special Sessions.

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

## Conferences

January 10 and 11, 1994: AMS Short Course on Complex Analytic Dynamics, Cincinnati, Ohio.

June 20–July 1, 1994: AMS-SIAM Summer Seminar in Applied Mathematics on Dynamical Systems and Probabilistic Methods for Nonlinear Waves, Mathematical Sciences Research Institute, Berkeley, California.

## Other Events Cosponsored by the Society

October 15–17, 1993: Second International Conference on Ordinal Data Analysis, University of Massachusetts, Amherst. Cosponsored by the University of Massachusetts, Technische Hochschule Darmstadt, and the Classification Societies of North America and Germany.

February 18–23, 1994: Section A (Mathematics) Sessions at the AAAS Annual Meeting, San Francisco, California.

## Deadlines

	December Issue	January Issue	February Issue	March Issue
Classified Ads*	November 11, 1993	December 8, 1993	January 5, 1994	January 26, 1994
News Items	October 28, 1993	December 1, 1993	December 23, 1993	January 17, 1994
Meeting Announcements**	November 2, 1993	December 2, 1993	December 30, 1993	January 20, 1994

\* Please contact AMS Advertising 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

### 973 1993 Steele Prizes

The 1993 Steele Prizes were awarded at the International Joint Mathematics Meetings in Vancouver, British Columbia, to Walter Rudin for expository mathematical writing, to George Daniel Mostow for research work of fundamental importance, and to Eugene B. Dynkin for the career award.

### 978 Theorems for a Price: Tomorrow's Semi-Rigorous Mathematical Culture *Doron Zeilberger*

"The computer has already started doing to mathematics what the telescope and microscope did to astronomy and biology," writes Zeilberger in this thought-provoking article on one of the most controversial questions in mathematics today: What will happen to conventional mathematical "rigor" in an age when computers are transforming the notion of proof?

### 982 Fermat Fest Draws a Crowd

Would 1000 members of the general public show up for an evening of mathematics talks? You bet. In July the Mathematical Sciences Research Institute filled a 1000-seat hall for public lectures on Andrew Wiles's announcement of his proof of Fermat's Last Theorem. Allyn Jackson describes why this sellout event was such a hit.

## FEATURE COLUMNS

### 985 Computers and Mathematics *Keith Devlin*

Geometry is the focus of this month's column, with two main articles. Mark Phillips, Silvio Levy, and Tamara Munzner of the Geometry Center in Minnesota write about *Geomview*, the geometry visualization tool developed there. Then, William V. Habegger and John W. Emert compare *Cabri-Géomètre* with *The Geometer's Sketchpad*. In addition Gene Klotz provides some information on the Geometry Forum, an electronic bulletin board for geometers.

### 994 Inside the AMS

This month's column contains an updated list of the Society's non-user-specific electronic addresses.

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# NOTICES OF THE

AMERICAN MATHEMATICAL SOCIETY

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## ADVERTISING

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## From the Executive Director . . .

### EXTREME LANGUAGE

The Senate Appropriations Subcommittee for VA, HUD, and Independent Agencies, which has responsibility for the National Science Foundation (NSF), has made its fiscal year 1994 recommendations. The recommended increase of approximately 9% for the NSF looks good, especially in these times of budget reductions and given the fact that the subcommittee recommended only about a 2% total increase for all the agencies under its jurisdiction.

However, a closer look will alarm those who recognize the unique role NSF plays in support of basic research, particularly its role in providing nearly 65% of all federal support to mathematics research. The Senate report recommends that funding for NSF support of basic research activities grow by only 4.4%, slightly better than the expected rate of inflation. This portends decreases in the support of mathematics beyond that suffered in FY93. An increase of 4.4% translates into an increase of approximately \$27 million in the budget of the Directorate for Mathematical and Physical Sciences. This directorate has prior commitments for construction of nonacademic facilities that require an amount well in excess of the \$27 million. The result will be that support for investigator research will suffer even more in FY94 than it did in FY93.

The lack of support for research and related activities at NSF is disturbing. Accompanied by the language of the subcommittee's report, this represents an attack on the value of basic research, an attack that has taken on some favor in federal science policy. This language is extreme considering the responsibility expected from the Senate subcommittee.

The report states:

- "[NSF] is at a crossroads in its future."
- "[The NSF] can be at the heart of helping to shape the administration's science and technology policy in pursuit of specific national goals, or it can diminish into becoming nothing more than a national endowment for science."
- "[The NSF needs] to engage our country's basic research enterprise to focus more clearly on the transfer of knowledge and technology for broader national goals and objectives."
- "[It] is time for the [NSF] to move to identify that which is specific, immediate, and realizable in pursuit of this broader mission."
- "Not less than 60% of the [NSF's] annual program research activities should be strategic in nature. The Foundation should make clear how it specifically defines each area so as not to shroud curiosity-driven activities under the rubric of strategic activities."
- "[If] the NSF and its constituent members choose not to do this, future federal R&D budgets should instead be allocated more generously to agencies such as NIST, NASA, the national energy labs, and NIH, all of whom seem poised to pursue critical technological problems with entrepreneurial vigor and enthusiasm."
- "[T]he academic research community should see it as perhaps the last, best chance to seize the opportunity to be an integral part of the solution to the scientific and technological problems our country and its economy now confront."

This extreme language signals a giant step away from support of basic science research, a step that is potentially devastating to this nation's future for leadership in science and technology. The AMS Washington Office and the Joint Policy Board for Mathematics have been working with staff of the Senate Appropriations Subcommittee to moderate this view as the Senate and House confer. The AMS Committee on Science Policy has held discussions with representatives from NSF. A number of representatives from the mathematics community have visited senators who are members of this subcommittee. Because it is unlikely that the Senate report language can be changed, emphasis is being placed on support for the FY94 recommendation from the House, which was considerably higher and much less prescriptive than that from the Senate. The societal and economic environment that is breeding and supporting this jaundiced view of support for basic research is a major concern that calls for us not only to resist this view but to advance the awareness and appreciation of basic science and to connect it to the needs of society.

William Jaco



## Letters to the Editor

### Rising Journal Prices; Decreasing Library Budgets

The UCLA Mathematics Department maintains a reading room which carries subscriptions to about 130 major journals and monograph series in mathematics. In recent years we have come under the double pressure of increasing costs and declining budgets, and lately we have learned that some cancellations will be necessary. As members of the committee charged with overseeing this collection, we decided to write to all the editors of the cancelled journals, informing them of our decision and explaining its rationale. Our purpose here is to encourage other libraries and departments facing cancellations to similarly inform the editors of affected publications.

We are acutely aware of the fact that editors do not control the cost of the journals they serve. On the other hand, it seems to us that part of the problem is that consumers, authors, and editors have, for too long, ignored questions of price and value. (To illustrate with some leading journals, how many of us know that the annual cost of a subscription to the *Annals of Mathematics* is about \$180, and to the *Journal of the AMS* approximately \$150, whereas the commercially published *Inventiones Mathematicae* costs \$2,312 a year? Of course to be fair, we should note that prices per page would show a less dramatic discrepancy.) At UCLA—and no doubt elsewhere—our goal has been to maximize the scientific benefit derived from a fixed or shrinking library budget. It seems to us that editors should likewise be encouraged to consider the matter of price and its consequences. Hopefully, increasing the awareness of

the problem will speed the evolution of a solution to this very vexing situation.

Robert Lazarsfeld  
Murray Schacher  
University of California  
at Los Angeles (UCLA)  
(Received June 10, 1993)

I have just received the yearly harbinger of the fall season: the letter from our Mathematics Department Librarian listing the current crop of journals that are being proposed for cancellation. The list includes, with each journal, the percentage increase in price for the current year. It is difficult to avoid the conclusion that once again publishers are attempting to exploit the natural inclination of departments of mathematics to protect one of their most important resources, namely, their research journal collection in the face of shrinking support for library acquisitions. I believe that there is a viable alternative to either cancellation or submission, and I put forward the following "modest proposal". Every research journal has an editorial board without which it could not function. The members of these boards are our colleagues, and it is clearly in all of our interests to contain what appears to be unconscionable price increases. I therefore call upon the members of the editorial boards of each mathematics journal to meet and evaluate the justifications given by their publisher for the current crop of price increases. If they decide that these increases are not justified by legitimate cost increases, then I suggest they request that the publisher reconsider those increases. If they conclude that the publisher is behaving irresponsibly, then they should resign their positions and publicly request that no member of the mathematical community accept an offer to serve on those boards.

Paul M. Weichsel  
University of Illinois  
at Urbana-Champaign  
(Received August 2, 1993)

### Moving the Joint Meetings from Denver

I am saddened by the recent decision of the AMS to enforce political correctness by boycotting the people of Colorado.

Colorado's Amendment 2 prohibited giving gays a special status. The amendment received some support from Coloradans involved in civil rights (for racial minorities) and the Amendment is not the unreasonable act that many paint it to be.

The AMS will lose considerable money when it backs out of contracts with Denver businesses. This money—which could have been used for a variety of programs promoting mathematics—has been sacrificed so that the AMS could make a political statement. As a member of the AMS I object to both the political statement and to the financial waste.

Ken W. Smith  
Central Michigan University  
(Received July 30, 1993)

### Letters to the Editor

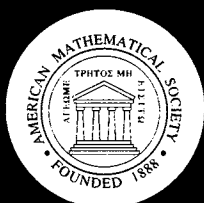
Letters submitted for publication in the *Notices* are reviewed by the Editorial Committee.

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](mailto:notices@math.ams.org), and will be acknowledged on receipt.



## Centennial Fellowships

### Invitation for Applications, 1994–1995

*Deadline December 1, 1993*

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, 1982, and December 31, 1987, 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 1994–1995 has been set by the Trustees of the Society at \$42,600 for nine months. In addition, there will be an expense allowance of \$1,400. 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 several years.

The deadline for receipt of applications is **December 1, 1993**. 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](mailto: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.)



# 1993 Steele Prizes

Three Leroy P. Steele Prizes were awarded at the International Joint Mathematics Meetings in Vancouver, British Columbia.

These prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein and 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 WALTER RUDIN for the expository award, GEORGE DANIEL MOSTOW for research work of fundamental importance, and EUGENE B. DYNKIN for the career award. The prizes were presented at the AMS-CMS-MAA opening banquet on August 15, 1993, at the International Joint Mathematics Meetings in Vancouver.

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, Sylvain E. Cappell, Vaughan F. R. Jones, Harry Kesten, Joseph J. Kohn, Robert P. Langlands, Paul Rabinowitz, Jane Cronin Scanlon, and Jean E. Taylor.

The text that follows contains the committee's citations for each award, the recipients' responses, and a brief biographical sketch of each recipient. The biographical sketches were written by the recipients or were based on information provided by them.

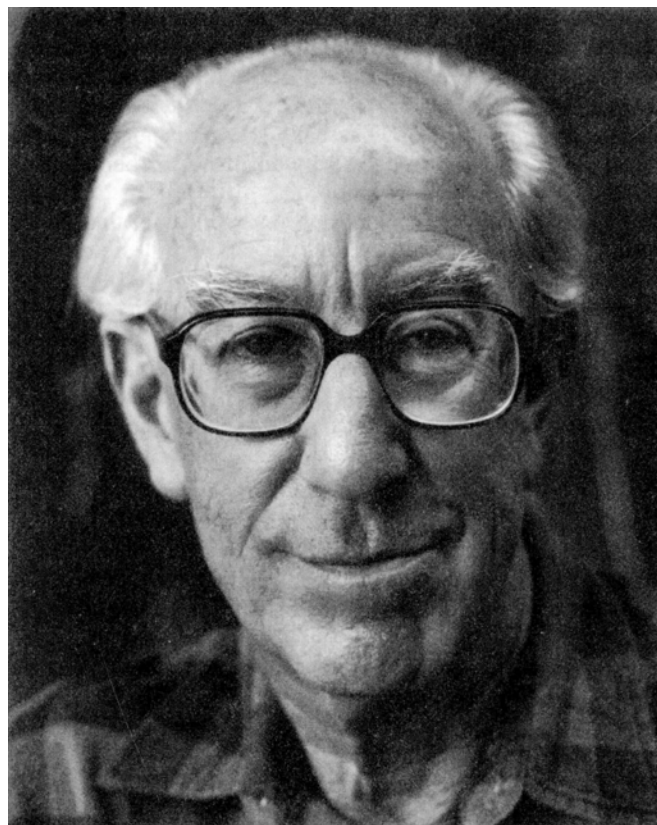
## Expository Writing

### Walter Rudin

#### Citation

To Walter Rudin for his books, in particular the classics *Principles of Mathematical Analysis* and *Real and Complex Analysis*. These books have served as the introduction to analysis to several generations of students both in the United States and abroad. They have set a standard for what undergraduate mathematics majors and beginning graduate students should know of analysis. The books are characterized by Rudin's personal style of elegance, clarity, and brevity. While giving

full treatments of many important subjects, these books have presented their wealth of material to students in an integrated, coherent, and unified development. In writing these textbooks Rudin exhibits the same care, depth, and originality that can be found in his high-quality research monographs.



Walter Rudin

#### Biographical Note

Rudin was born in Vienna in 1921. After receiving his Ph.D. from Duke University in 1949, Rudin's academic career has included teaching at MIT (Moore Instructor, 1950–1952), the University of Rochester (1952–1959), and the University of Wisconsin, Madison (1959–1991) where he is currently Professor Emeritus. Rudin was a Sloan Fellow

(1956–1960). His research interests include mathematical analysis, especially abstract harmonic analysis, Fourier series, and holomorphic functions of one and several variables.

### Response

One of my first duties as a Moore Instructor was to teach an Advanced Calculus course in which a certain list of topics was to be covered. When I said, “But there is no good book which contains all of this,” Ted Martin, who was department chairman and also a consulting editor for McGraw-Hill, answered, “Why don’t you write one?” So I did. *Principles of Mathematical Analysis* was published in 1953 and, to my amazement, is still going strong forty years later. I very much wanted to present a beautiful and important part of mathematics in a straightforward, logical, well-organized way, with complete and concise proofs. Constructing the book gave me real pleasure. That it turned out to be so successful is, of course, a welcome additional bonus.

*Real and Complex Analysis* was harder to write. I started it because the traditional Real Variables and Complex Variables courses were usually so structured that neither of these areas even acknowledged the existence of the other. The resulting mathematical version of apartheid gave students quite a misleading impression of what really goes on in analysis. That the book was so well received by so many mathematicians made it all worthwhile.

I thank the AMS for honoring my work with this Steele Prize.

## Fundamental Paper

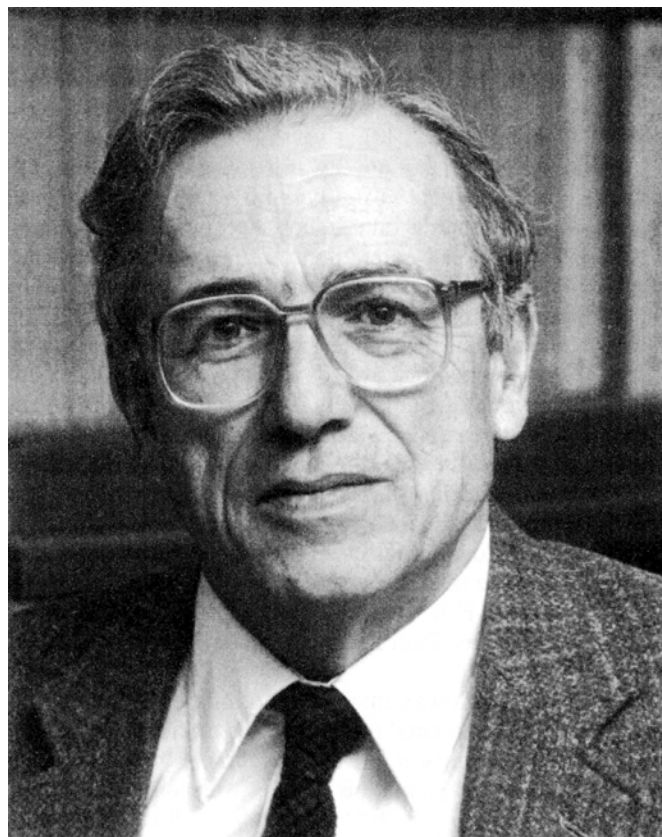
**George Daniel Mostow**

### Citation

To George Daniel Mostow for his monograph on strong rigidity. The Strong Rigidity Theorems of Mostow proven in his *Annals of Math. Studies*, vol. 78 (1973) are central and landmark achievements in modern mathematics. Previously there had been the local rigidity results of Selberg, Calabi-Vesentini, and Weil. These assert that if  $\Gamma \leq G$  is a lattice (that is, a finite co-volume discrete subgroup) of a semisimple Lie group  $G$  which is (essentially) not  $SL_2(\mathbb{R})$ , then all local deformations of  $\Gamma$  arise from conjugations by elements of  $G$ ; that is, there are no deformations.

Mostow’s *Annals Study* (and his paper in I.H.E.S. Publications, 1967) changed the subject by proving the first global results. First, in the I.H.E.S. paper he showed that if  $G$  is the isometry group of hyperbolic  $n$ -space  $n \geq 3$ ,  $\Gamma_1$  and  $\Gamma_2$  lattices in  $G$  and  $\Theta: \Gamma_1 \rightarrow \Gamma_2$  is a group isomorphism of  $\Gamma_1$  to  $\Gamma_2$ , then they are conjugate in  $G$ . In this paper Mostow introduces the crucial idea of extending equivariant maps (which are defined via  $\Theta$ ) to the boundary of hyperbolic space. He then uses and develops creatively the theory of quasiconformal maps and ergodic theory to construct the conjugation. In his *Annals of Math. Study* Mostow proves the strong rigidity theorem for all semisimple groups  $G$  (not  $SL_2(\mathbb{R})$ ). The other cases of real

rank 1 are dealt with by techniques similar to the hyperbolic space case but are by no means easy. Indeed, his treatment of the complex, quaternionic, and Cayley hyperbolic spaces is an excellent source for the study of these spaces. The higher rank groups are also dealt with by extending maps to the boundary but also making extensive use of the rich combinatorial structure of the boundary (e.g., Tits buildings) to construct the conjugation. Besides the greatness of these results, these papers are beautifully written. The reader not only learns the proofs but gains many other insights along the way. A number of fundamental concepts which were central in other new directions (pseudo-isometry, quasiconformal mapping over division algebras, etc.) were introduced in this paper.



George Daniel Mostow

Improvements of Mostow’s methods have led to the proof of many other results (super-rigidity for lattices and for cocycles for group actions on measure spaces, strong rigidity for discrete subgroups more general than lattices, etc.). Moreover, the strong rigidity theorems are some of the deepest and most important results used regularly by topologists working with hyperbolic 3-manifolds for they assert that the fundamental group of such a (say, compact) manifold determines the hyperbolic structure uniquely. Sullivan gave important extensions of Mostow’s rigidity and techniques to Kleinian groups in  $SL_2(\mathbb{C})$ . The most striking development beyond (and partly from) Mostow’s papers is that of Margulis.



He proved “super-rigidity” in rank  $\geq 2$ . In particular he showed that all lattices in higher rank groups come from arithmetic constructions.

A geometric development emerging from Mostow’s papers was achieved by Siu (1980). He gave a new proof of Mostow’s strong rigidity for certain hermitian symmetric spaces using harmonic maps. In this way the rigidity could be stated and proved in the geometric context of Kähler manifolds (with certain negative curvature assumptions). Recently the subject took a big step forward when Corlette, using Siu’s methods but applied to quaternionic hyperbolic space, proved archimedean superrigidity for these real rank 1 lattices. This was an unexpected result. It was followed by Gromov and Schoen’s recent proof of arithmeticity for such lattices.

It is clear that the subject initiated by Mostow is still very much alive and exciting. To quote M. Gromov (see his paper “Asymptotic invariants of infinite groups”, p. 11), “The hyperbolic geometry took a new turn in 1968 when G.D. Mostow discovered his amazing asymptotic proof of the rigidity of lattices in  $O(n, 1)$ .” These papers of Mostow merit this award both in their own right as foundational achievements and as the fountainhead of this great stream of mathematics.

### Biographical Note

Mostow was born in Boston in 1923 and received his Ph.D. from Harvard in 1948. He began his academic career as an instructor of mathematics at Princeton (1947–1948) and was a member at the Institute for Advanced Study (1947–1949). He was an assistant professor at Syracuse University (1949–1952), then moved to Johns Hopkins (1952–1961), where he advanced to professor. Mostow is currently at Yale University, where he has served as department chair (1971–1974), the James E. English Professor (1963–1983), and Henry Ford II Professor of Mathematics (1983–).

During his 44-year membership in the Society Mostow has served admirably in many capacities, most notably as president (1987–1989). He was a Guggenheim Fellow (1958) and is a member of both the National Academy of Sciences and the American Academy of Arts and Sciences. He served on the Executive Committee of the International Mathematical Union (1983–1987), the Board of Trustees of the Institute for Advanced Study (1982–1992), and the Scientific Advisory Council of the Mathematical Sciences Research Institute (1988–1991).

### Response

The honor that the American Mathematical Society bestows upon me is the most meaningful professional reward to which I aspire. I am deeply grateful.

The work that has been cited brought me great pleasure as it evolved. And on this occasion it is appropriate to share some of that experience with you and to add some historical remarks. My point of view emerged from trying to understand the deformation results of Selberg, Calabi-Vesentini, and Weil as a geometric phenomenon. Thereby, I was led to look at the infinitely far regions of the symmetric spaces associated

with the relevant groups—that is, at their boundaries. In the *Proceedings of the 1965 Boulder Summer Institute on Algebraic Groups and Discrete Subgroups*, I published an intermediate result: if a lattice isomorphism induces a smooth mapping of the corresponding boundaries, then the lattice isomorphism extends to a group isomorphism. Curiously, the proof was highly algebraic, involving case-by-case checking of root diagrams.

This result thus posed the challenge: how to prove that the mapping of a symmetric space induced by a lattice isomorphism extends to a smooth mapping at the boundary? I was stuck at that point until one day I inquired of my next door office neighbor, Tsuneo Tamagawa, if he had ever encountered such an extension phenomenon. “Why, yes,” replied Tamagawa, “I had a friend in Japan, A. Mori, who studied such a phenomenon in the plane for mappings that he called quasiconformal.” That was the first time I heard the word “quasiconformal”.

After absorbing the literature on quasiconformal mappings, I found that the 1962 paper of Fred Gehring on quasiconformal mappings in three space allowed me to prove the existence of the extension for real hyperbolic  $n$ -space. But still lacking was the reason why the boundary mapping had to be smooth. The reason for that hit me one day at the corner of Whalley Avenue and Fitch Street in New Haven as I waited in my car for the traffic light to turn green.

The idea was to exploit the ergodic action of the group of homotheties in the space of all lattices in this group. Thereby one could show for the case of real hyperbolic space that the boundary map was not only smooth but even Moebius. Over the ensuing few years, in combination with other ideas, a corresponding result was obtained for every group except  $SL_2(\mathbf{R})$ , in which the rigidity phenomenon does not occur.

The pleasurable excitement of working that out was its own reward. The subsequent contributions to rigidity of Prasad, Margulis, Sullivan, Zimmer, Siu, Mok, Pansu, Corlette, Gromov-Schoen added to the pleasure. The topological results of Thurston and Farrell-Jones added even more. Your award today makes my cup run over.

### Career Award

### Eugene B. Dynkin

#### Citation

Eugene B. Dynkin has made major contributions to the theory of Lie algebras and to probability theory. Dynkin’s most famous contribution to the theory of Lie algebras was his use of the “Coxeter-Dynkin diagrams” to describe and classify the Cartan matrices of semisimple Lie algebras. This work was done while Dynkin was still a student at Moscow University.

Even though Dynkin has directed many Ph.D. theses in Lie group/algebra theory, most of his career has been devoted to probability theory. Dynkin has laid much of the foundations of the general theory of Markov processes as we know it today. His books (*Foundations of the Theory of Markov Processes*,

Moscow 1959, translation published by Pergamon 1960; and *Markov Processes*, vols. I and II, Moscow, 1963, translation published by Springer-Verlag, 1963) have had a tremendous influence. He formulated and proved the strong Markov property (in 1956, together with his student Yushkevitch; this was done almost at the same time and independently of Hunt's introduction of the strong Markov property). Dynkin proved the measurability of certain hitting times (again almost at the same time as Hunt and independently of him). He developed the semigroup theory of Markov processes and characterized Markov processes by the generator of their semigroup. He also showed the usefulness of what is now known as "Dynkin's formula". This formula, which expresses expectations of functionals of the Markov process as an integral involving its generator, has become a standard and indispensable tool which is still used all the time. Dynkin further studied such topics as excessive functions, Martin boundary, additive functionals, entrance and exit laws, random time change, control theory, and mathematical economics.



Eugene B. Dynkin

Around 1980 Dynkin interpreted and vastly generalized an identity which had first come up in the context of quantum field theory. In his hands it became a remarkable relation between occupation times of a Markov process and a related Gaussian random field. This identity has led to many deep studies, by Dynkin himself as well as a host of others, of the properties of local times of Markov processes as well as to

the detailed study of multiple points or self-intersections of Brownian motion.

In the last few years Dynkin has obtained exciting results in the theory of "super processes". This is a class of measure-valued Markov processes, which in many cases can be constructed as a suitable scaled limit of branching processes. These processes can be used to give probabilistic solutions to certain nonlinear PDE's in a way which is analogous to the classical solution of the Dirichlet problem by means of Brownian motion. Dynkin has used this to relate analytic properties of solutions of such PDE's (e.g., removability of singularities) to probabilistic properties of super processes.

Even though Dynkin has dealt with quite concrete probability problems, one of his strengths is his ability to build general theories and an apparatus to answer broad questions (e.g., characterize a certain natural class of additive functionals of a Markov process, or find all super processes with a branching property).

The list of Dynkin's Ph.D. students in Moscow is a "Who's Who" in Russian probability theory. In Moscow he has been extremely active in a special high school for gifted students in mathematics. He has also had many Ph.D. students since he immigrated to the U.S. He has been invited several times to speak at the International Congress of Mathematicians, and he is a member of the National Academy of Sciences.

This career award is in recognition of Dynkin's foundational contributions to two areas of mathematics over a long period and his production of outstanding research students in both countries to whose mathematical life he contributed so richly.

### Biographical Note

Dynkin was born in Leningrad on May 11, 1924. After receiving his Ph.D. from Moscow University in 1948 he ultimately became professor at the same institution and held that position until 1968. He was a senior research fellow at the Academy of Sciences, Moscow (1968–1976). Since 1977 he has been a professor of mathematics at Cornell University.

He received the Prize of the Moscow Mathematical Society (1951) and also served on the council and as vice-president of that organization. He is a member of the National Academy of Sciences; the American Academy of Arts and Sciences; the Institute of Mathematical Statistics; and the Bernoulli Society for Mathematics, Statistics, and Probability. His research interests include Lie theory and probability theory, stochastic processes, optimal control, probabilistic models of economic growth and equilibrium, and sufficient statistics.

### Response

I feel deeply honored to have been awarded a Steele Prize by the American Mathematical Society.

I came to the United States from the Soviet Union in 1977. Since then I have taught at Cornell University, a great center in probability theory. I found here kind and friendly colleagues; gorgeous scenery of forests, lakes, and waterfalls; and a few bright graduate students with whom I have started a seminar of the Moscow type. The most exciting was a



new feeling of freedom and independence of big and little bosses—something which I never enjoyed in my previous life.

I had a great advantage to spend my formative years in an extremely stimulating atmosphere of the Moscow mathematical school; to be a pupil of such great mathematicians as A. N. Kolmogorov, I. M. Gelfand, I. F. Petrovskii; and later to enjoy interaction with brilliant young mathematicians who started their research at my seminars, among them are (in chronological order) R. L. Dobrushin, F. I. Karpelevich, A. V. Skorokhod, F. A. Berezin, A. A. Yushkevich, I. V. Girsanov, Ya. G. Sinai, A. L. Onishchik, R. Z. Khasminskii, V. A. Volkonskii, M. I. Freidlin, M. G. Shur, A. A. Kirillov, A. D. Wentzell, E. B. Vinberg, V. N. Tutubalin, N. V. Krylov, S. A. Molchanov, M. B. Malyutov, G. A. Margulis, S. E. Kuznetsov, I. V. Evstigneev, M. I. Taksar. On the other hand, the life was hard under the oppression of a totalitarian regime. I was eleven when my family was exiled from Leningrad to Kazakhstan and I was thirteen when my father, one of millions of Stalin's victims, disappeared in the Gulag. It was almost a miracle that I was admitted (at the age of sixteen) to Moscow University. Every step in my professional career was difficult because the fate of my father, in combination with my Jewish origin, made me permanently undesirable for the party authorities at the university. Only special efforts by A. N. Kolmogorov, who put, more than once, his influence at stake, made it possible for me to progress through the graduate school to a teaching position at Moscow University.

My poor vision made me unfit for the draft, so during the war I continued my undergraduate study. The motherly attitude of S. A. Yanovskaya (a professor at Moscow University) softened the hardship of the most difficult years and allowed me to concentrate on mathematics. (Her support and encouragement are gratefully remembered by a number of other mathematicians and logicians.) I worked at Gelfand's seminar on Lie groups and at Kolmogorov's seminar on Markov chains. Both were important for my development as a research mathematician.

Gelfand requested that I review the H. Weyl-Van der Waerden papers on semisimple Lie groups. I found them very difficult to read, and I tried to find my own ways. It came to my mind that there is a natural way to select a set of generators for a semisimple Lie algebra by using simple

roots (i.e., roots which cannot be represented as a sum of two positive roots). Since the angle between any two simple roots can be equal only to  $\frac{\pi}{2}$ ,  $\frac{2\pi}{3}$ ,  $\frac{3\pi}{4}$ ,  $\frac{5\pi}{6}$ , a system of simple roots can be represented by a simple diagram. An article was submitted to *Matematicheskii Sbornik* in October 1944. Only a few years later, when recent literature from the West reached Moscow, I discovered that similar diagrams have been used by Coxeter for describing crystallographic groups.

Lie algebras remained my main field for about ten years. I used simple roots and the corresponding diagrams to investigate automorphisms and semisimple subalgebras of Lie algebras. After coming to the West I learned that these results have been used by a number of physicists to deal with elementary particles. (I was flattered when Yuval Ne'eman told me that his work on this subject was based on my dissertation, which he had read in one of the London libraries.)

A few times I was lucky to find a new approach which simplified an important theory. One of them is related to the celebrated Campbell-Hausdorff theorem claiming that the formal series  $\log(e^Xe^Y)$  can be expressed in terms of commutators. In 1947 I found a simple explicit expression: it is sufficient to replace all multiplications by commutators and then to divide each monomial by its degree. My debut in probability theory was made about the same time as my debut in algebra. In 1945 I solved a problem on Markov chains posed by Kolmogorov. In 1948 I became an assistant professor at Kolmogorov's Probability Chair, and I continued to work on probability and statistics parallel to algebra (the results on exponential families and sufficient statistics are probably the best known). Beginning in the middle of the 1950s, I switched almost completely to work on stochastic calculus, especially on Markov processes. Some detail about this part of my research can be found in the citation.

Contacts with my friends and colleagues in the Soviet Union were severed when I moved to the United States. Now, after the end of the Cold War, they flourish again. We started a joint project with S. E. Kuznetsov and A. V. Skorokhod on the structure of branching measure-valued processes. During my recent visits to Moscow we had two very emotional reunions with a large group of scientists who were my pupils in the 1960s in a special Moscow high school for mathematically gifted students.

# Theorems for a Price: Tomorrow's Semi-Rigorous Mathematical Culture

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Doron Zeilberger received his Ph.D. under the direction of Harry Dym in 1976 from the Weizmann Institute of Science, Israel. He is the husband of Jane Legrange, and the father of Celia, Tamar, and Hadas.

## Today

The most fundamental precept of the mathematical faith is *thou shalt prove everything rigorously*. While the practitioners of *mathematics* differ in their view of what constitutes a rigorous proof, and there are fundamentalists who insist on even a more rigorous rigor than the one practiced by the mainstream, the belief in this principle could be taken as the *defining property of mathematician*.

## The Day after Tomorrow

There are writings on the wall that, now that the silicon savior has arrived, a new testament is going to be written. Although there will always be a small group of “rigorous” old-style mathematicians (e.g., [JQ]) who will insist that the true religion is theirs and that the computer is a false Messiah, they may be viewed by future mainstream mathematicians as a fringe sect of harmless eccentrics, as mathematical physicists are viewed by regular physicists today.

The computer has already started doing to mathematics what the telescope and microscope did to astronomy and biology. In the future not all mathematicians will care about absolute certainty, since there will be so many exciting new facts to discover: mathematical pulsars and quasars that will make the Mandelbrot set seem like a mere Galilean moon. We will have (both human and machine<sup>2</sup>) professional *theoretical* mathematicians, who will develop conceptual paradigms to make sense out of the empirical data and who will reap Fields medals along with (human and machine) *experimental* mathematicians. Will there still be a place for *mathematical* mathematicians?

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<sup>2</sup>For example, my computer Shalosh B. Ekhad and its friend Sol Tre, already have a nontrivial publication list, e.g., [E], [ET]

This will happen after a transitory age of *semi-rigorous mathematics* in which identities (and perhaps other kinds of theorems) will carry price tags.

## A Taste of Things to Come

To get a glimpse of how mathematics will be practiced in the not-too-distant future, I will describe the case of algorithmic proof theory for *hypergeometric identities* [WZ\*, Z\*, Ca]. In this theory it is possible to rigorously prove, or refute, any conjectured identity belonging to a wide class of identities, which includes most of the identities between the classical special functions of mathematical physics.

Any such identity is proved by exhibiting a *proof certificate* that reduces the proof of the given identity to that of a finite identity among rational functions and, hence, by clearing denominators, to that between specific polynomials.

This algorithm can be performed successfully on all “natural identities” we are now aware of. It is easy, however, to concoct artificial examples for which the running time and memory are prohibitive. Undoubtedly, in the future “natural” identities will be encountered whose complete proof will turn out to be not worth the money. We will see later how, in such cases, one can get “almost certainty” with a tiny fraction of the price along with the assurance that, if we robbed a bank, we would be able to know for sure.

This is vaguely reminiscent of *transparent proofs* introduced recently in theoretical computer science [Ci, ALMSS, AS]. The result that there exist short theorems having arbitrarily long proofs, a consequence of Gödel’s incompleteness theorem, also comes to mind [S].<sup>3</sup> I speculate that similar developments will occur elsewhere in mathematics and will “trivialize” large parts of mathematics by reducing mathematical truths to routine, albeit possibly very long and exorbitantly expensive to check, “*proof certificates*”. These proof certificates would also enable us, by plugging in random values, to assert “probable truth” very cheaply.

## Identities

Many mathematical theorems are *identities*, statements of type “=”, which take the form  $A = B$ . Here is a sample, in

<sup>3</sup>Namely, the ratio (proof length)/(theorem length) grows fast enough to be nonrecursive. Adding an axiom can shorten proofs by recursive amounts [G, D].

roughly an increasing order of sophistication.

1.  $2 + 2 = 4$ .
2.  $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ .
3.  $\sin(x + y) = \sin(x)\cos(y) + \cos(x)\sin(y)$ .
4.  $F_{n+1}F_{n-1} - F_n^2 = (-1)^{n+1}$ .
5.  $(a + b)^n = \sum_{k=0}^n \binom{n}{k} a^k b^{n-k}$ .
6.  $\sum_{k=-n}^n (-1)^k \binom{2n}{n+k}^3 = \binom{3n}{n}$ .
7. Let  $(q)_r := (1 - q)(1 - q^2) \cdots (1 - q^r)$ , then

$$\sum_{r=0}^n \frac{q^{r^2}}{(q)_r (q)_{n-r}} = \sum_{r=-n}^n \frac{(-1)^r q^{(5r^2-r)/2}}{(q)_{n-r} (q)_{n+r}}.$$

- 7'. Let  $(q)_r$  be as in 7.

$$\sum_{r=0}^{\infty} \frac{q^{r^2}}{(q)_r} = \prod_{i=0}^{\infty} (1 - q^{5i+1})^{-1} (1 - q^{5i+4})^{-1}.$$

8. Let  $H_n$  be given by

$$H_n = H_n(q) = \frac{(1+q)(1+q^2)}{(1-q)(1-q^2)} \cdots \frac{(1+q^n)}{(1-q^n)},$$

then

$$\left( \sum_{k=0}^n \frac{2(-q^{n+1})^k}{1+q^k} H_k \right)^4 \sum_{k=-n}^n \frac{4(-q)^k}{(1+q^k)^2} \frac{H_{n+k}}{H_n} \frac{H_{n-k}}{H_n} = \left( \sum_{k=-n}^n (-q)^{k^2} \right)^4.$$

- 8'.

$$\left( \sum_{k=-\infty}^{\infty} q^{k^2} \right)^4 = 1 + 8 \sum_{k=1}^{\infty} \frac{q^k}{(1+(-q)^k)^2}.$$

9. Analytic Index=Topological Index.

10.  $\text{Re}(s) = \frac{1}{2}$  for every nonreal  $s$  such that  $\zeta(s) = 0$ .

All the above identities are trivial, except possibly the last two, which I think quite likely will be considered trivial in two hundred years. I will now explain.

### Why Are the First 8 Identities Trivial?

The first identity, while *trivial* nowadays, was very deep when it was first discovered, independently, by several anonymous cave dwellers. It is a general abstract theorem that contains, as special cases, many apparently unrelated theorems—Two Bears and Two Bears Make Four bears, Two Apples and Two Apples Make Four Apples, etc. It was also realized that, in order to prove it rigorously, it suffices to prove it for any one special case, say, marks on the cave's wall.

The second identity,  $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ , is one level of generality higher. Taken literally (in the semantic sense of the word *literally*), it is a fact about *numbers*. For any specialization of  $a$  and  $b$  we get yet another correct numerical fact, and as such it requires a "proof", invoking the commutative, distributive, and associative "laws". However, it is completely routine when viewed *literally*, in the syntactic sense, i.e., in which  $a$  and  $b$  are no longer symbols denoting numbers but rather represent themselves, qua (commuting) literals. This shift in emphasis roughly corresponds to the transition from *Fortran* to *Maple*, i.e., from *numeric* computation to *symbolic* computation.

Identities 3 and 4 can be easily embedded in classes of routinely verifiable identities in several ways. One way is by defining  $\cos(x)$  and  $\sin(x)$  by  $(e^{ix} + e^{-ix})/2$  and  $(e^{ix} - e^{-ix})/(2i)$  and the Fibonacci numbers  $F_n$  by Binet's formula.

Identities 5–8 were, until recently, considered genuine nontrivial identities, requiring a human demonstration. One particularly nice human proof of 6 was given by Cartier and Foata [CF]. A one-line computer-generated proof of identity 6 is given in [E]. Identities 7 and 8 are examples of so-called *q-binomial coefficient identities* (a.k.a. *terminating q-hypergeometric series*). All such identities are now routinely provable [WZ2] (see below). The machine-generated proofs of 7 and 8 appear in [ET] and [AEZ] respectively. Identities 7 and 8 immediately imply, by taking the limit  $n \rightarrow \infty$ , identities 7' and 8', which in turn are equivalent to two famous number-theoretic statements: The first Rogers-Ramanujan identity, which asserts that the number of partitions of an integer into parts that leave remainder 1 or 4 when divided by 5 equals the number of partitions of that integer into parts that differ from each other by at least 2; and Jacobi's theorem which asserts that the number of representations of an integer as a sum of 4 squares equals 8 times the sum of its divisors that are not multiples of 4.

### The WZ Proof Theory

Identities 5–8 involve sums of the form

$$\sum_{k=0}^n F(n, k), \quad (\text{Sum})$$

where the summand,  $F(n, k)$ , is a *hypergeometric term* (in 5 and 6) or a *q-hypergeometric term* (in 7 and 8) in both  $n$  and  $k$ , which means that both quotients,  $F(n+1, k)/F(n, k)$  and  $F(n, k+1)/F(n, k)$ , are *rational functions* of  $(n, k)$  ( $(q^n, q^k, q)$  respectively).

For such sums and multisums we have [WZ2] the following result.

### The Fundamental Theorem of Algorithmic Hypergeometric Proof Theory:

Let  $F(n; k_1, \dots, k_r)$  be a *proper* (see [WZ2]) hypergeometric term in all of  $(n; k_1, \dots, k_r)$ . Then there exist polynomials

$p_0(n), \dots, p_L(n)$  and rational functions  $R_j(n; k_1, \dots, k_r)$  such that  $G_j := R_j F$  satisfies

$$\sum_{i=0}^L p_i(n) F(n+i; k_1, \dots, k_r) = \sum_{j=1}^r [G_j(n; k_1, \dots, k_j+1, \dots, k_r) - G_j(n; k_1, \dots, k_j, \dots, k_r)] \quad (\text{multiWZ})$$

Hence, if for every specific  $n$ ,  $F(n; -)$  has compact support in  $(k_1, \dots, k_r)$ , the definite sum  $g(n)$  given by

$$g(n) := \sum_{k_1, \dots, k_r} F(n; k_1, \dots, k_r) \quad (\text{multisum})$$

satisfies the linear recurrence equation with polynomial coefficients:

$$\sum_{i=0}^L p_i(n) g(n+i) = 0. \quad (P\text{-recursive})$$

( $P$ -recursive) follows from (multiWZ) by summing over  $\{k_1, \dots, k_r\}$  and observing that all the sums on the right telescope to zero.

If the recurrence happens to be first order, i.e.,  $L = 1$  above, then it can be written in *closed form*: for example, the solution of the recurrence  $(n+1)g(n) - g(n+1) = 0$ ,  $g(0) = 1$ , is  $g(n) = n!$ .

This “existence” theorem also implies an algorithm for finding the recurrence (i.e., the  $p_i$ ) and the accompanying certificates  $R_j$  (see below).

An analogous theorem holds for  $q$ -hypergeometric series [WZ2, K].

Since we know how to find and prove the recurrence satisfied by any given hypergeometric sum or multisum, we have an effective way of proving any equality of two such sums or the equality of a sum with a conjectured sequence. All we have to do is check whether both sides are solutions of the same recurrence and match the appropriate number of initial values. Furthermore, we can also use the algorithm to find new identities. If a given sum yields a first-order recurrence, it can be solved, as mentioned above, and the sum in question turns out to be explicitly evaluable. If the recurrence obtained is of higher order, then most likely the sum is not explicitly evaluable (in closed form), and Petkovsek’s algorithm [P], which decides whether a given linear recurrence (with polynomial coefficients) has *closed form* solutions, can be used to find out for sure.

### Almost Certainty for an $\epsilon$ of the Cost

Consider identity (multisum) once again, where  $g(n)$  is “nice”. Dividing through by  $g(n)$  and letting  $F \rightarrow F/g$ , we can assume that we have to prove an identity of the form

$$\sum_{k_1, \dots, k_r} F(n; k_1, \dots, k_r) = 1. \quad (\text{Nice})$$

The WZ theory promises that the left side satisfies some linear recurrence, and if the identity is indeed true, then the sequence  $g(n) = 1$  should be a solution (in other words,  $p_0(n) + \dots + p_L(n) \equiv 1$ ). For the sake of simplicity let’s assume that the recurrence is minimal, i.e.,  $g(n+1) - g(n) = 0$  (This is true anyway in the vast majority of the cases). To prove the identity by this method, we have to find *rational functions*  $R_j(n; k_1, \dots, k_r)$  such that  $G_j := R_j F$  satisfies

$$F(n+1; k_1, \dots, k_r) - F(n; k_1, \dots, k_r) = \sum_{j=1}^r [G_j(n; k_1, \dots, k_j+1, \dots, k_r) - G_j(n; k_1, \dots, k_j, \dots, k_r)]. \quad (\text{multiWZ}')$$

By dividing (multiWZ') through by  $F$  and clearing denominators, we get a certain functional equation for the  $R_1, \dots, R_r$ , from which it is possible to determine their denominators  $Q_1, \dots, Q_r$ . Writing  $R_j = P_j/Q_j$ , the proof boils down to finding *polynomials*  $P_j(k_1, \dots, k_r)$  with coefficients that are rational functions in  $n$  and possibly other (auxiliary) parameters. It is easy to predict upper bounds for the degrees of the  $P_j$  in  $(k_1, \dots, k_r)$ . We then express each  $P_j$  symbolically with “undetermined” coefficients and substitute into the above-mentioned functional equation. We then expand and equate coefficients of all monomials  $k_1^{a_1} \dots k_r^{a_r}$  and get an (often huge) system of inhomogeneous linear equations with *symbolic* coefficients. The proof comes down to proving that this inhomogeneous system of linear equations has a solution. It is very time-consuming to solve a system of linear equations with *symbolic* coefficients. By plugging in specific values for  $n$  and the other parameters if present, one gets a system with *numerical* coefficients, which is much faster to handle. Since it is unlikely that a random system of inhomogeneous linear equations with more equations than unknowns can be solved, the solvability of the system for a number of special values of  $n$  and the other parameters is a very good indication that the identity is indeed true. It is a waste of money to get absolute certainty, unless the conjectured identity in question is known to imply the Riemann Hypothesis.

### Semi-Rigorous Mathematics

As wider classes of identities, and perhaps even other kinds of classes of theorems, become routinely provable, we might witness many results for which we would know how to find a proof (or refutation); but we would be unable or unwilling to pay for finding such proofs, since “almost certainty” can be bought so much cheaper. I can envision an abstract of a paper, c. 2100, that reads, “We show in a certain precise sense that the Goldbach conjecture is true with probability larger than 0.99999 and that its complete truth could be determined with a budget of \$10 billion.”

It would then be acceptable to rely on such a priced theorem, provided that the price is stated explicitly. Whenever statement  $A$ , whose price is  $p$ , and statement  $B$ , whose price is  $q$ , are used to deduce statement  $C$ , the latter becomes a priced theorem priced at  $p + q$ .



If a whole chain of boring identities would turn out to imply an interesting one, we might be tempted to redeem all these intermediate identities; but we would not be able to buy out the whole store, and most identities would have to stay unclaimed.

As absolute truth becomes more and more expensive, we would sooner or later come to grips with the fact that few non-trivial results could be known with old-fashioned certainty. Most likely we will wind up abandoning the task of keeping track of price altogether and complete the metamorphosis to nonrigorous mathematics.

**Note:** *Maple* programs for proving hypergeometric identities are available by anonymous ftp to math.temple.edu in directory pub/zeilberger/programs. A *Mathematica* implementation of the single-summation program can be obtained from Peter Paule at paule@risc.uni-linz.ac.at.

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# Fermat Fest Draws a Crowd

## *1000 People Attend an Evening of Public Lectures Sponsored by MSRI*

Nobody quite knew what to expect when the Mathematical Sciences Research Institute (MSRI) rented a 1000-seat hall in San Francisco to present public lectures on Fermat's Last Theorem. The evening program took place July 28, 1993, just five weeks after Andrew Wiles announced his proof in a now-famous lecture at the Isaac Newton Institute in Cambridge, England. The theorem states that the equation  $x^n + y^n = z^n$  has no nonzero solutions in the positive integers when  $n \geq 3$ , and its proof has stymied and mystified professional and amateur mathematicians alike. Wiles's announcement electrified not only the mathematical community but the general public as well, spawning news reports all over the globe. Certainly there was interest. But could MSRI fill 1000 seats?

They can and did—they even did it a day ahead of time. Nobody dreamed it would be a sellout. “The mathematicians who were there were flabbergasted” when they saw how many people showed up, said MSRI Deputy Director Lenore Blum. For mathematics, the Fermat Fest, as it came to be called, was probably one of the most successful public outreach events ever held. According to William P. Thurston, director of MSRI, the mathematical community is often skeptical that the public has any interest in mathematics. “The Fermat Fest shows that there are lots of people who will like mathematics if it's presented well,” he declared. “We try to tell people they should be interested in mathematics and say why it's important to their lives. That just makes people feel guilty—it doesn't make them like it. But the Fermat Fest was appealing because of the human element and because it's just interesting. It's not because the mathematics was disguised as something else.”

### **\$5 Tickets Scalped for \$25**

Everyone was surprised at the interest in the Fermat Fest, including the Exploratorium, the San Francisco science museum that agreed to sponsor the event. The sellout left a couple of hundred people at the mercy of scalpers, who commanded \$25 for the \$5 tickets. There were survey cards asking the audience who they were and why they had come, but in the last minute crunch only about 200 were handed out, so there is no precise information on who showed up. But, looking around the hall, it was striking to note that the audience was more mixed in terms of gender, age, and race than audiences at typical mathematics lectures.

One man said he came because his niece, a mathematician at a university in Florida, had asked him to, but also because Fermat's Last Theorem “holds a fascination because so many people have tried to prove it.” A group of about sixteen graduate students from Stanford drove up to attend the event. One woman brought her son, a high school freshman who, if motherly praise can be trusted, is something of a math whiz. Taking up her knitting, she confessed that she didn't expect to understand much, but once the proceedings were under way, she put down her knitting from time to time and listened intently.

### **The Smell of the Greasepaint. . .**

In the days before the Fermat Fest, MSRI began to resemble the backstage of a theater. Staff accosted each other in the hallways to ask in eager tones how ticket sales were going. When half the tickets were sold about five days before the show, there were whispers that it might be a sellout. The show was on a Wednesday, and spirits sagged on Monday after reports of disappointing ticket sales over the weekend. Word came on Tuesday that it had already sold out, and the tension heightened.

After a rehearsal on Monday was not quite up to snuff, they reshuffled the speakers and scheduled a second run-through on Tuesday. There was even a dress rehearsal a few hours before the big event. Despite all the preparation, there were a few last minute glitches: one of the speakers showed up in shorts and was told he'd have to have long pants for the show; fortunately, someone lent him the pair *he* was wearing. Of course, there were certain hazards that no amount of rehearsing could prevent. At one of the rehearsals, Hendrik Lenstra of UC Berkeley wondered aloud, “What if someone discovers a mistake in the proof before Wednesday?”

### **Pizza and Fermat's Last Theorem**

When the Fermat Fest began, the first to step up to the microphone was Will Hearst, editor and publisher of the *San Francisco Chronicle*. Hearst, who has had a soft spot for mathematics ever since he majored in the subject in college, held everything together as master of ceremonies. As he put it, the purpose of the event was not to communicate Wiles's proof in a technical way but rather to “get a hold of the general concepts and feel the flow”: to get an inkling of the proof,

to understand the importance of Wiles's work, and to get a sense of the culture of mathematics, what mathematicians do, what they are like. After describing what Fermat's Last Theorem says, he introduced the program: "Now comes the fun part—how do we know it's true?"

The first speaker, MSRI Deputy Director Robert Osserman, talked about the case  $n = 2$ , the Pythagorean Theorem. He took a practical approach, asking whether it makes more sense to buy a large pizza, or one small and one medium. To howls of laughter from the audience, he used a "pizza cutter" to test the idea out on cardboard disks that he placed on the overhead projector. Setting the half-disks so that their diameters formed a triangle, he noted that if the angle across from the large "pizza" was less than ninety degrees, it pays to get a medium and a small instead of a large, whereas if it's greater than ninety it's better to get the large. The only case in which it doesn't matter which you buy is when the angle is precisely ninety degrees.



Robert Osserman, MSRI deputy director (Photo courtesy of Arlene Baxter)

He also described a relationship between Pythagorean triples and when musical notes make harmonious sounds. As an example he used a contraption consisting of two large right-triangular pieces of wood, along the sides of which ran strings that could be plucked. (At this point in the proceedings Thurston made a cameo appearance carrying one of the props out on stage, along with Sean Brennan, a Berkeley mathematics undergraduate who works at MSRI.) One was a 3-4-5 triangle, and the strings, when plucked, gave off a harmonious sound. But because the other was an isosceles right triangle, the sides were in the ratio  $\sqrt{2}$ , creating the discordant *diabolus in musica*.

## Rollicking Lehrer Tunes

On that note came the first of two musical interludes, which primarily consisted of rollicking mathematics songs written by Tom Lehrer and sung by Morris Bobrow. One of them, called "That's Mathematics" and sung to the tune of "That's Entertainment", may never have been performed before, according to Bobrow. The absurdly funny "Derivative Song" warmed the hearts of every former and current calculus student in the audience, as did the bittersweet love song "There's a Delta for Every Epsilon". Rumor had it that Lehrer, a mathematician at the University of California at Santa Cruz, was in the audience, but this was not confirmed.

Lenore Blum described some of the history behind Fermat's Last Theorem. Fermat did not realize that when he wrote his legendary marginal comment—that he had discovered a "truly wonderful proof which this margin is too small to contain"—he was writing for posterity. It was simply an offhand note to himself, recorded in his copy of Diophantus's *Arithmetica*. Blum pointed out that although Fermat was involved in the mathematics of his era, he suffered from "writer's block" and published almost nothing. "I don't know about tenure for this guy," she quipped.



Lenore Blum, MSRI deputy director (Photo courtesy of Arlene Baxter)

In 1816 the French Academy of Sciences offered a prize for a proof of Fermat's Last Theorem, setting off a flurry of activity that has continued to this day. Blum said that in the competition for the prize both Lamé and Cauchy submitted incorrect proofs. Kummer pointed out the errors in the proofs, but said he thought the general approach could be salvaged. In attempting to do so, Kummer laid the foundations for algebraic number theory.

### **“I finally understood what modular means!”**

Moving up to 1993, Karl Rubin of Ohio State University took on the challenge of explaining to the audience what an elliptic curve is and what it means for one to be modular; two key concepts in Wiles’s proof. It seemed that his explanation was helpful to some of the mathematically literate in the audience as well: at the intermission a mathematics graduate student said, “I finally understood what modular means!” Rubin used the elliptic curve  $y^2 = x(x - A)(x - B)$  as an example. Taking  $A = 1$  and  $B = -1$  and rewriting the equation as  $y^2 - x^3 + x$ , Rubin explained modularity in the following way. Suppose  $p$  is an odd prime and  $N_p$  is the number of points  $(x, y)$  such that  $0 \leq x, y \leq p - 1$  and  $y^2 - x^3 + x$  is a multiple of  $p$ . The sequence  $N_p$  has some interesting patterns; for example, Gauss observed in 1814 that if  $p$  is  $1 \pmod{4}$ , then  $N_p = p$ . The upshot of Rubin’s explanation is that the elliptic curve is modular if the sequence of  $N_p$  exhibits a certain structure.

The curve Rubin picked for his explanation is an important ingredient in the story of the proof of Fermat’s Last Theorem. Back in 1985 Gerhard Frey suggested that if there was a nontrivial solution  $(a, b, c)$  to  $x^n + y^n = z^n$ , then one can write down a curve that violates the Taniyama Conjecture, which says that all elliptic curves are modular. According to Frey the curve  $y^2 = x(x - a^n)(x + b^n)$  provided an example of a nonmodular elliptic curve. In 1986 Kenneth Ribet of the University of California at Berkeley proved that this curve is not modular, and hence that the Taniyama Conjecture implies Fermat’s Last Theorem.

### **The Role of Cappuccino in the Proof**

Ribet’s talk at the Fermat Fest, which began with his initial contact with Frey and described the events leading up to Wiles’s announcement of a proof, provided a bird’s-eye view on how research gets done in mathematics. Sipping a cappuccino during the International Congress of Mathematicians in Berkeley in 1986, Ribet had discussed with Barry Mazur of Harvard University his ideas for proving Frey’s assertions. That was when Ribet realized that he had a complete proof, though the paper was only published in 1990. Wiles immediately set about proving the Taniyama Conjecture as soon as he heard of Ribet’s result, despite the fact that most experts in the area considered Taniyama out of reach.

The final speaker before intermission was John Conway of Princeton University, who presented his own “personal history” of Fermat’s Last Theorem, beginning with pictures of ancient tablets showing that the Babylonians understood and

utilized the Pythagorean Theorem (though they did not prove it). Conway continued the “countdown”: 1800 years before the Fermat Fest, Diophantus writes *Arithmetika*; 392 years before, Fermat is born; 356 years before, he writes his famous marginal comment in his copy of *Arithmetika*; six months before, Wiles tells his Princeton colleagues Nicholas Katz and Peter Sarnak that he “nearly has a proof” of Fermat; five weeks before, at 5:53 a.m. on June 23, 1993, Conway learns via e-mail that Wiles had announced his proof in Cambridge; and twenty hours before, Conway arrives at the San Francisco airport to present his talk.

After the intermission there was a panel discussion with Blum, Conway, Ribet, and journalist Lee Dembart, who has an interest in mathematics. Hearst posed questions collected from the audience during the break. One of the questions, “Is this a Golden Age for mathematics?”, drew immediate and emphatic answers of “Yes!” from the panelists.

The last question asked where people who believed they have proved Fermat’s Last Theorem could send their manuscripts. The panelists looked confused. Somewhere in the middle of the hall, a man stood up waving a sheaf of paper. “I’ve proved it in fifty pages! I can give it to you right here.” Another man raised his hand to indicate that he, too, had proved the result. On that note, Hearst quickly wrapped up the show.

### **The Right Answer**

Thurston says that MSRI will continue to organize public outreach efforts like the Fermat Fest. Although Fermat’s Last Theorem holds a special mystique for the general public, Thurston believes that if channels to reach people were developed, it would be possible to address many other mathematical topics. “I think it’s a fraction of the potential audience,” he says. “We [at MSRI] believe it’s important to reach out to the general public. Up to now, MSRI has had hardly any name recognition beyond the mathematical community. It’s important to try to get publicity for mathematics as a whole,” he said, “so that people know the right answer to the question, ‘Is this a Golden Age for mathematics?’ ”

*Note:* A videotape of this event, entitled “Fermat’s Last Theorem and Its Proof: An Exploration of Issues and Ideas,” is now available from MSRI, 1000 Centennial Dr., Berkeley, CA 94720. Please see MSRI’s ad in the back of this issue of the *Notices*.

**Allyn Jackson**



*Edited by Keith Devlin*

## This month's column

Geometry is the focus of this month's column, with two main articles. Mark Phillips, Silvio Levy, and Tamara Munzner of the Geometry Center in Minnesota write about *Geomview*, the geometry visualization tool developed there. Then, William V. Habegger and John W. Emert compare *Cabri-Géomètre* with *The Geometer's Sketchpad*. In addition, Gene Klotz provides some information on the Geometry Forum, an electronic bulletin board for geometers.

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## **Geomview: An Interactive Geometry Viewer**

**Mark Phillips\*, Silvio Levy\*,  
and Tamara Munzner\***

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### Introduction

For many people mathematical thought is highly visual. We frequently draw diagrams while working out ideas and talking to each other. These diagrams rarely make it into research papers, however. One of the main reasons for this is that drawing good pictures is difficult. The diagrams we draw by hand are often stylized and cryptic and require a lot of explanation.

One of the purposes of the Geometry Center is to explore the use of computer graphics as a tool for understanding and communicating mathematical ideas. One of our main efforts to this end is a program called *Geomview*. Its main purpose is to display objects whose geometry is given, allowing interactive

control over details such as point of view, speed of movement, appearance of surfaces and lines, and so on. *Geomview* can handle any number of objects and allows both separate and collective control over them. The data can come from a file or from another program that is running simultaneously. In the second case, as the other program changes the data, the *Geomview* image reflects the changes.

In general *Geomview*'s purpose is to handle the *display* and *interaction* aspects of the presentation of geometric data. The data must come from somewhere else. The idea is that many aspects of the display and interaction parts of geometry software are independent of the geometric content and can be collected together in a single piece of software that can be used in a wide variety of situations.

### History of *Geomview*

*Geomview* has evolved through several phases. It began in the summer of 1989 with a project of Pat Hanrahan's. Pat saw a need for a simple interactive viewing program for the Silicon Graphics (SGI) workstations at the Geometry Center (then the Geometry Supercomputer Project). Many sophisticated CAD/CAM and other specialized programs existed that included 3-D viewing capabilities, but they were not very well suited for visualizing mathematics. They were frequently expensive and hard to use, and the collection of graphics primitives that they could display could not be extended. The program that Pat wrote was called *MinneView*, in honor of the city of its birth. It used an extensible Object Oriented Graphics Library (OOGL) designed by Charlie Gunn, which provided a unified way of dealing with a wide variety of graphics objects.

*MinneView* was an immediate hit at the Geometry Center because it was so easy to use. The user would type *MinneView* filename, and a window would appear with a picture of the data in the file. The user could then translate, rotate, and scale the image in the window with the mouse. Over the next year or so, many features were added to *MinneView* to support such things as light placement, stereo viewing, animation, and communication with external programs via shared memory. Stuart Levy joined the effort and implemented many of these. *MinneView* was used extensively by staff and visitors at the Geometry Center.

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As *MinneView* grew, structural limitations became apparent. The program depended on specific aspects of the computer system at the Geometry Center, such as the existence of certain files, and hence was difficult to use outside the Center. As features were added, its user interface became awkward to use. It ran only on SGI workstations and was written in a way that was not easily portable to other platforms. In general it suffered from having been pushed far beyond its original purpose. Since experience with it clearly indicated that such a tool was very useful, the staff decided to rewrite it with a new design that would be more flexible and portable and which would include a better user interface.

This programming effort took over two years of part-time work, primarily by Stuart Levy, Tamara Munzner, and Mark Phillips. It involved writing nearly 40,000 lines of code and led to the first public release of the newly named "*Geomview*" in February 1992. Since then we have released several new versions, and substantial contributions have been made by Celeste Fowler and Nathaniel Thurston.

The *Geomview* code is organized according to an object-oriented design philosophy. However, it is written in C, a language that does not directly support object-oriented programming. The main reason for the choice of language is that we wanted the program to be widely accessible and easily portable—even today there is still no object-oriented language that is nearly as standardized and as widely available as C.

One of the main points of rewriting *MinneView* was to make it portable to computers other than SGI workstations. *Geomview* is written using a device-independent graphics library that can, in theory, be made to work on any computer. Most of our effort has gone into the SGI version, however, because we believe that SGI workstations have the best price/performance ratio in terms of 3-D graphics. We started work on a Sun version but set it aside because the 3-D graphics performance of the Sun, even with a GX graphics card, was very poor. Dan Krech and Scott Wisdom are working on a NeXT implementation of *Geomview*. We hope to port *Geomview* to the 486 PC with the NeXTStep operating system once that platform becomes available.

Many people have asked why we don't have a version of *Geomview* for the Macintosh or for generic X windows workstations, since this would reach a much larger audience than our current SGI and NeXT versions. The main reason is that the lack of time and labor has forced us to focus on the hardware that we believe is best suited for this kind of software. Other versions may come in the future as staff resources permit.

### Overview of *Geomview*'s Capabilities

The simplest use of *Geomview* is to view and manipulate a single static object. The object comes from an appropriately formatted file of data points. *Geomview* accepts a variety of file formats; one of the most useful is called OFF (Object File Format) and describes a collection of polygons in 3-space with (possibly) shared vertices and edges. There are also file formats for describing meshes, Bezier patches, curves, spheres, and compound objects. A window appears with an

image of the object in it, and the user can translate, rotate, and scale the object by moving the mouse in the window while holding down a mouse button.

*Geomview* uses the "glass sphere" model for mouse-based motion. This means you are supposed to think of the object as being inside an invisible sphere, and the mouse cursor is a gripper outside the sphere. When you hold down the left mouse button, the gripper grabs the sphere; when you let go of the button, the gripper releases the sphere. Moving the mouse while holding the button down causes the sphere (and hence the object) to move in the same direction as the mouse. For rotation it is as if you were spinning the object about its center. For translation the object simply follows the mouse. Motions in *Geomview* have inertia: if you release the button while moving the mouse, the object will continue moving at a constant rate.

*Geomview* can display any number of objects at one time. There is always a "target", which is the object that is the target of mouse motions. In addition to any of the individual objects, the target can be the entire "world", in which case mouse motions apply to the union of all objects as if it were a single object.

*Geomview* can work with hyperbolic and spherical geometry as well as Euclidean. This is a fortunate side effect of the fact that 3-D graphics software libraries use projective transformations in homogeneous coordinates ( $4 \times 4$  matrices) to effect transformations of  $R^3$ , and the isometry groups of Euclidean, hyperbolic, and spherical space are each subgroups of the projective group. Most of the internals of *Geomview* are independent of the particular geometry being used, the main difference being the computation of the particular  $4 \times 4$  matrices used. This is one of the ways in which *Geomview* differs from other viewing programs.

For simple viewing of a static object, *Geomview*'s mouse-based interactive motion facilities are sufficient. There are times, however, when you want to view data that is changing in time, perhaps under the control of some other program that is doing a computation such as integrating a flow or evolving a surface under the effect of certain forces. There are also situations when you want to be able to interact with the data to do something other than just move it—for example, to return a particular point in the data set back to a program doing computations with it. For these purposes *Geomview* has a command language that other programs may use to communicate with it. The command language is very general; anything that can be done via the mouse and keyboard in *Geomview* can also be done through the command language, plus a lot more.

One type of program that communicates with *Geomview* through the command language is called an "external module". An external module appears, from the user's point of view, to be a part of *Geomview* itself. Although it is invoked by selecting a menu entry in *Geomview*'s main panel, an external module is a separate program which extends *Geomview*'s functionality. External modules have been written for such tasks as viewing 4-D objects, exploration of 3-manifolds, visualizing symmetry groups, interactive clipping, creating

surfaces of revolution, animation, editing of motion paths, and more.

In conjunction with a *Mathematica* package and a C program, both written at the Geometry Center, *Geomview* can function as the display program for 3D *Mathematica* graphics. This setup also allows *Mathematica* to write a graphics object to a file which can be viewed later with *Geomview*. *Geomview* can also create output in RenderMan format, which is a commercial package for creating photorealistic images.

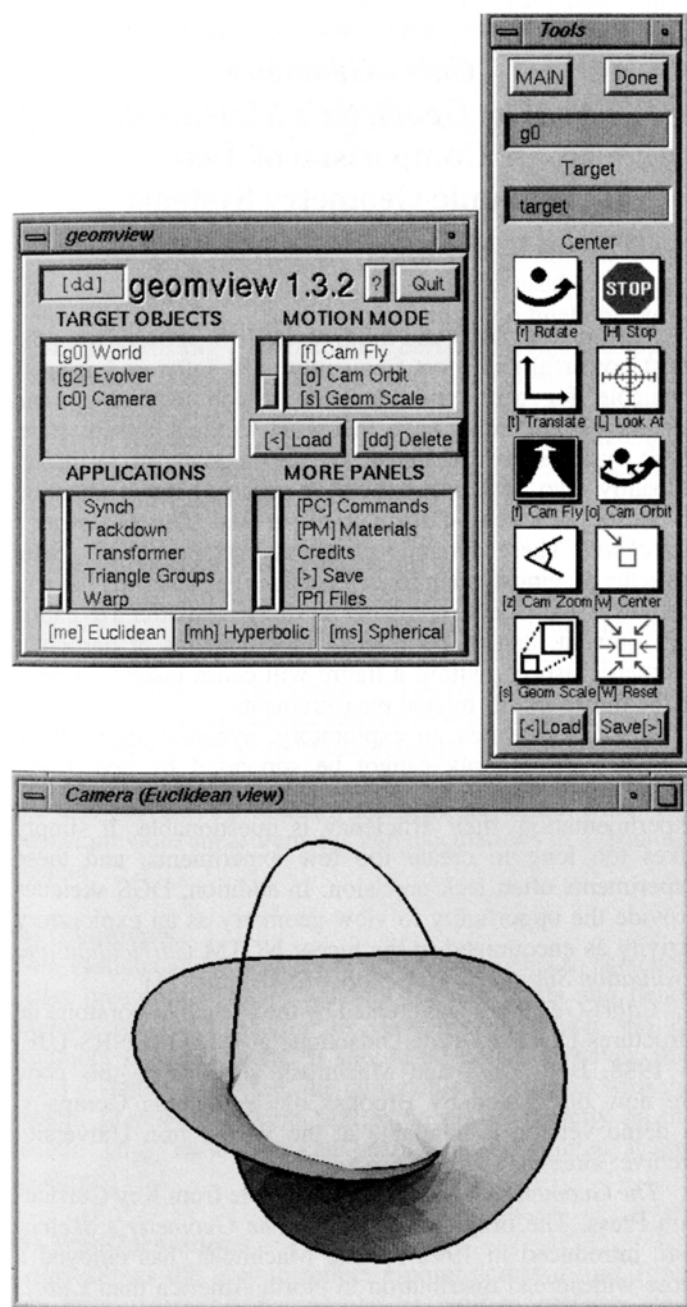


Figure 1: A typical *Geomview* session. The object in this picture is a soap film whose boundary lies on part of a trefoil knot; it was computed with Ken Brakke's *Surface Evolver* [1].

Documentation is currently restricted to Unix-style manual pages describing *Geomview*, its command language, the various file formats it accepts, and the existing external modules; there are also a few short tutorials. Work on a comprehensive user's guide is in progress.

### Future Directions

As we continue to fix bugs and add new features, *Geomview* has grown to be much larger than we originally envisioned. This is a natural result of software that is being developed and used at the same time. As we consider future directions, we recognize a definite need for more extensive documentation. Longer-term possibilities include implementations on platforms other than SGI and NeXT, a refinement of the command language and user interface, and streamlining the addition of new graphics primitives. Doing any of these might involve switching to a true object-oriented language.

### Conclusion: Why *Geomview*?

We wrote *Geomview* to fill a gap that we perceived in currently available software. It is intended to be a tool for allowing people to create and interact with visual representations of mathematical concepts. It was designed with the work of mathematicians in mind and is meant to be easy to use for simple things, such as rotating a single object on the screen with a mouse, and extensible enough to handle more complicated things, such as communication with an external program or display of higher-dimensional data. And last, but not least, it is free to anyone who wants it.

*Geomview* is used every day at the Geometry Center and has been retrieved by over 500 sites around the world. It has been interfaced with a number of other mathematical programs. For example, Ken Brakke's *Surface Evolver* [1] (see Figure 1), a program that models the evolution of surfaces driven by various forces, can use *Geomview* for its graphics display. Jeff Weeks's *Snappaea* [2] (see Figure 2 next page), a program for computing with hyperbolic structures on manifolds, can display the Dirichlet domain of a hyperbolic manifold in hyperbolic space using *Geomview*. Video production is another common use for *Geomview*; it is currently being used extensively at the Center in the making of the movie "Outside In" which deals with the eversion of the sphere.

In many ways *Geomview* is a prototype of the kind of program we believe can be very useful in mathematical visualization. It has been extremely useful at the Geometry Center and elsewhere, and we hope that its usefulness will improve as we continue to refine it. Perhaps more importantly, however, we hope that the best parts of it will set a precedent for a future generation of software at a time when visualization is moving to the forefront of the way we do and teach mathematics.

### Geomview Availability

*Geomview* is available free of charge via anonymous ftp on the Internet from [geom.umn.edu](http://geom.umn.edu) (IP address 128.101.25.35). A

package containing SGI executable programs for *Geomview* and many external modules, together with documentation and example data files, is available in the file `pub/geomview/geomview.tar.Z`. The source code is also available. We have an electronic mail address for correspondence regarding *Geomview* and other Geometry Center software; send questions to `software@geom.umn.edu`. Our mailing address is The Geometry Center, Suite 500, 1300 South Second Street, Minneapolis, MN 55454.

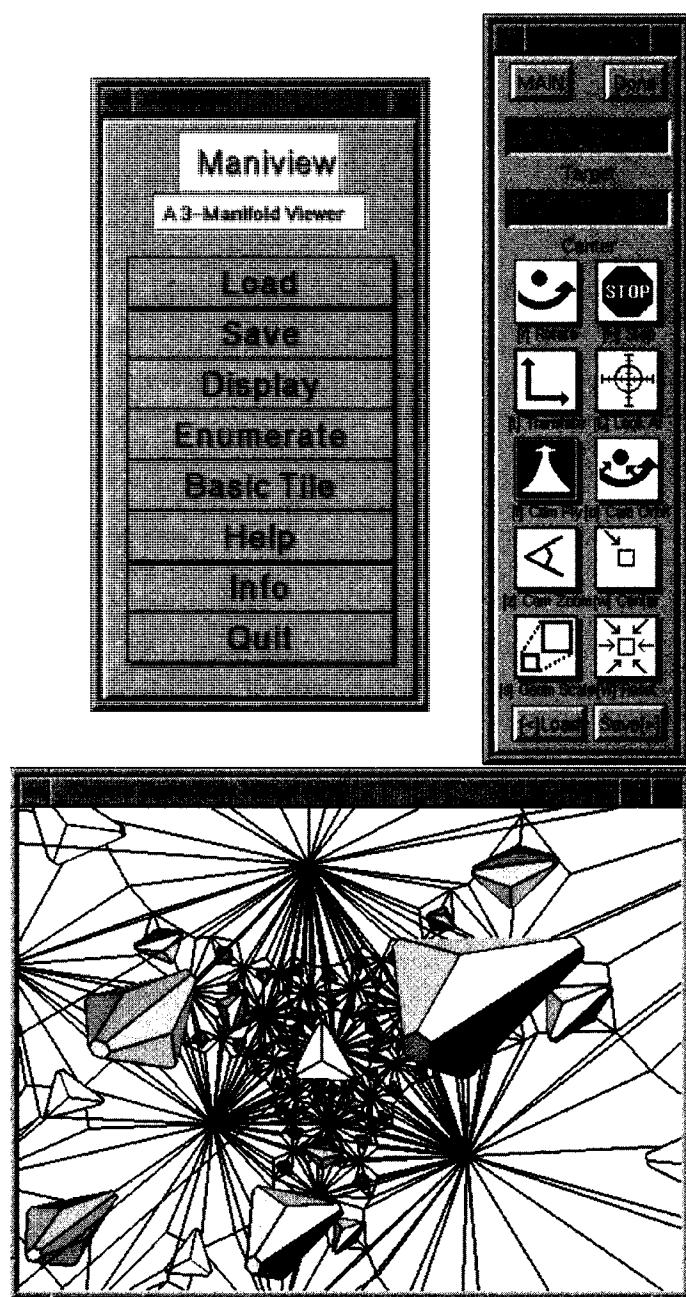


Figure 2: Maniview, a *Geomview* external module for viewing in 3-manifolds written by Charlie Gunn. This picture shows a view inside the figure eight knot complement with hyperbolic structure; the data was generated with Jeff Week's *Snappea* [2].

## References

- [1] Brakke, Kenneth A. *The Surface Evolver*, *Experimental Mathematics*, Vol. 1 (1992), No. 2. The *Surface Evolver* program is available via anonymous ftp from `geom.umn.edu` (128.101.25.35).
- [2] Weeks, J., *Snappea*, a computer program for creating and studying hyperbolic 3-manifolds, available via anonymous ftp from `geom.umn.edu` (128.101.25.35).

## Cabri-Géomètre vs. The Geometer's Sketchpad: A Comparison of Two Dynamic Geometry Systems

William V. Habegger\* and John W. Emert\*

Historically, *Logo* and the *Geometric Supposers* were the most powerful and most frequently used software packages available for geometry education. Since technology and hardware capabilities have increased to their present state, these systems are no longer the most powerful available. Recently, two new packages have received much attention in North America—*Cabri-Géomètre* and *The Geometer's Sketchpad*. These dynamic geometry systems (DGS) differ from the previously mentioned packages because they harness the power of available computer hardware and offer a dynamic environment; that is, continuous modifications of particular geometric aspects within a figure will cause instant changes to the figure and its related measurements.

A DGS provides an exploratory, dynamic approach to geometry that simply cannot be supported by pencil and paper. While traditional manipulatives may be helpful in experimentation, their efficiency is questionable. It simply takes too long to create too few experiments, and these experiments often lack precision. In addition, DGS sketches provide the opportunity to view geometry as an exploratory activity as encouraged in the recent NCTM *Curriculum and Evaluation Standards for School Mathematics* [1].

*Cabri-Géomètre* was created by the French Laboratoire de Structures Discrètes et de Didactique at IMAG (CNRS-UJF) in 1988. Both DOS and Macintosh versions of this code are now distributed by Brooks/Cole Publishing Company. A demo version is available at the Washington University archive: `wuarchive.wustl.edu`.

*The Geometer's Sketchpad* is available from Key Curriculum Press. The original version of *The Geometer's Sketchpad*, introduced in 1991 for the Macintosh, has enjoyed a more widespread distribution in North America than *Cabri-Géomètre*. A Windows version of *The Geometer's Sketchpad* was introduced in March 1993.

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This review compares *Cabri-Géomètre* version 2.1 and *The Geometer's Sketchpad* version 2.0, both running on a Macintosh LCII with System 7.

## Features Found in Both Systems, Contrasted

### (1) Creating a Locus of Points

Both *Cabri* and *Sketchpad* allow the user to modify a sketch while the locus of a chosen point is marked. Neither allows dynamic modification or preservation of the locus. *Cabri* does provide an option to draw automatically the locus in a continuous manner. See Figure 1 (next page) for a comparison of the loci from *Cabri* and *Sketchpad*. This figure also illustrates one use of the feature, showing the geometric construction of conic sections.

### (2) Macros

The sole purpose of macros in *Cabri* is to minimize work. They allow multistep operations to be condensed to a single menu command. By identifying the initial and final objects of an already-existing construction, *Cabri* will create the appropriate macro. *Sketchpad* takes a more algorithmic approach; the user must first declare the intention to create a macro and then record the construction step by step. *Sketchpad* macros can call themselves and therefore create recursive constructions; *Cabri* does not have this option.

### (3) Measurements and Calculations

In *Cabri*, angle measures and segment lengths can be superimposed on the figure. They remain positioned near the object and change dynamically. These measurements, as well as areas of circles and polygons, can be reported in table form. However, no true arithmetic calculations can be performed by *Cabri*. *Sketchpad* reports measurements and calculations as data whose locations are independent of their objects. *Sketchpad* also provides a pull-down scientific calculator, which can import previous measurements and calculations in a dynamic manner.

### (4) Comments

Both systems allow the user to attach comments to sketches. *Cabri* creates a separate window for comments and hence requires window rescaling to view both a sketch and its comment simultaneously. It should be noted, however, that when a sketch is printed, the comments are printed with the sketch. *Sketchpad* permits text to be placed directly on the sketch. Thus, comments can be placed and printed at any location.

### (5) Transformations

*Cabri* allows the user to reflect a point across a line. From this basic operation macros can be built to perform other transformational geometry constructions, but they quickly become complicated. *Sketchpad* provides a built-in selection of such transformational constructions as translations, reflections, rotations, and dilations that are easy to use.

### (6) Order of Object Selection

In the *Cabri* environment, commands are selected prior to the selection of objects. However, *Sketchpad* requires the opposite order of selection.

## Features Distinctive to *Cabri-Géomètre*

### (1) Check for Invariance

A principal feature of *Cabri* is its ability to check for "apparent" invariants within a geometric diagram. Properties that can be checked are collinearity (alignment), membership of a point on a line, parallelism, perpendicularity, and equality of segment lengths. *Cabri* apparently uses visual tests rather than logical deduction to choose one of the following responses:

(a) This property is not true.

(b) This property is true in general.

(c) This property looks true in this case of the figure but is false in general.

(d) This property is true for the figure, but *Cabri* cannot determine whether it is true in general.

If the property is true for the figure as drawn but false in general, *Cabri* will provide a counterexample. For example, Figure 2 (see page 991) illustrates a specific example where the angle bisector of a triangle appears to be perpendicular to the opposite side. This property is not true in all cases, and *Cabri* will offer a counterexample if requested.

*Cabri* almost always deduces the appropriate conclusion, although we found that it could sporadically report response (b) and (d) for the same construction.

We found the ability to check properties the most attractive feature of *Cabri*. For the learning and discovery of geometry this ability allows students to notice patterns and test conjectures. With minor debugging, annoying errors will hopefully be minimized.

### (2) Redefinition of objects

In a DGS it is necessary for the software to make distinctions concerning the relationships among the various objects, e.g., points on objects vs. points of intersection vs. free-moving points vs. midpoints vs. circle centers. At times it is convenient to revise these relationships; *Cabri* allows such changes.

### (3) Customized Construction Menu

*Cabri* permits menus to be customized so that particular commands are hidden. This allows for a structured development in the classroom. For example, the *Perpendicular bisector* construction command could be removed from the menu until students are familiar with the step-by-step process.

## Features Distinctive to *The Geometer's Sketchpad*

### (1) Action Buttons

*Sketchpad* allows the user to create on-screen buttons to perform an action on command. Two of the most useful action buttons are *Animate* and *Sound*.

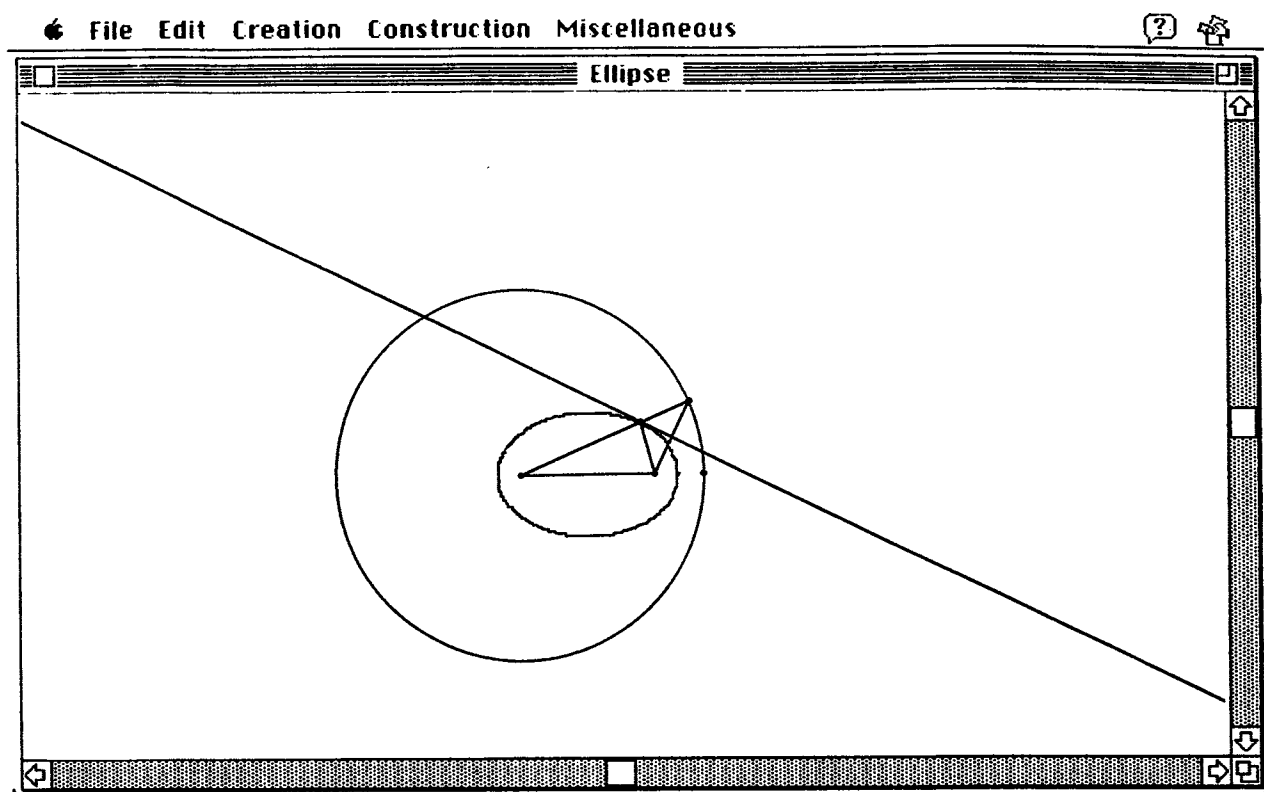


Figure 1a. An ellipse created as the locus of a point by *Cabri-Géomètre*.

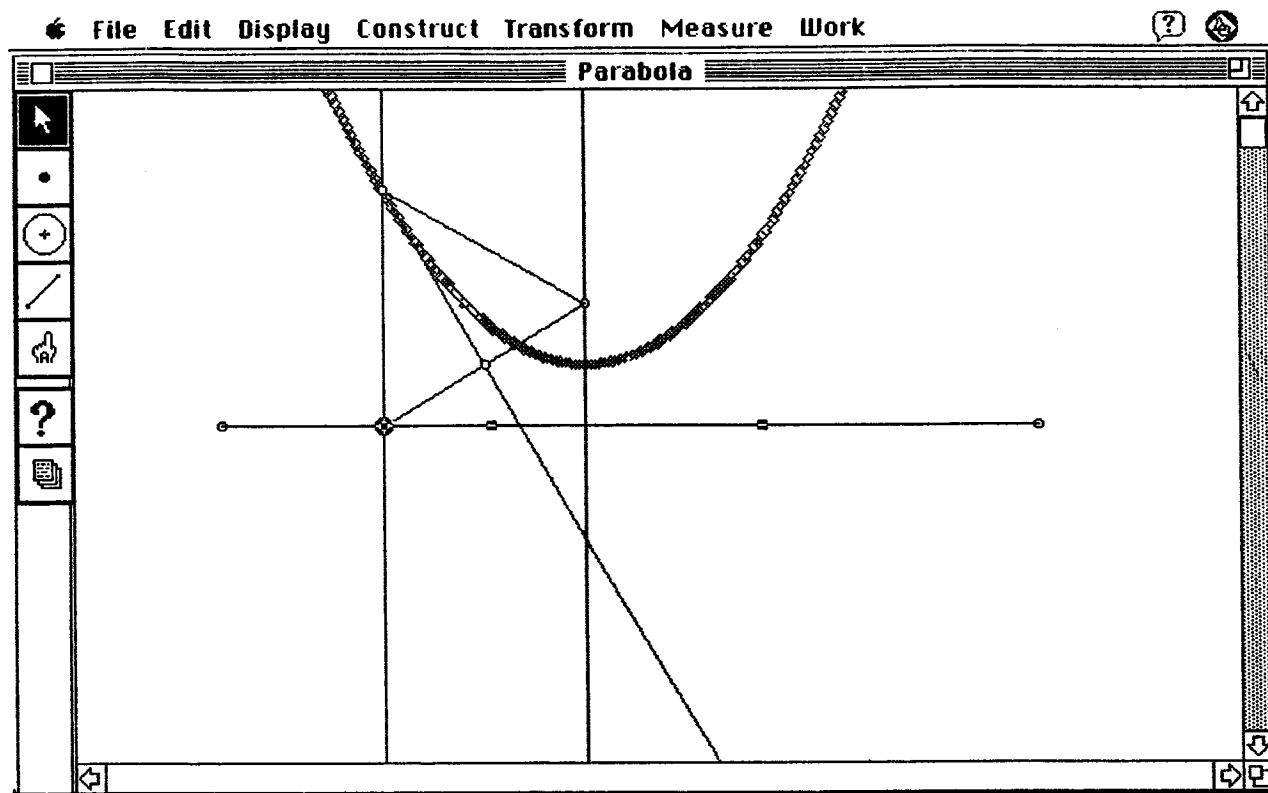


Figure 1b. A parabola created as the locus of a point by *Geometer's Sketchpad*.

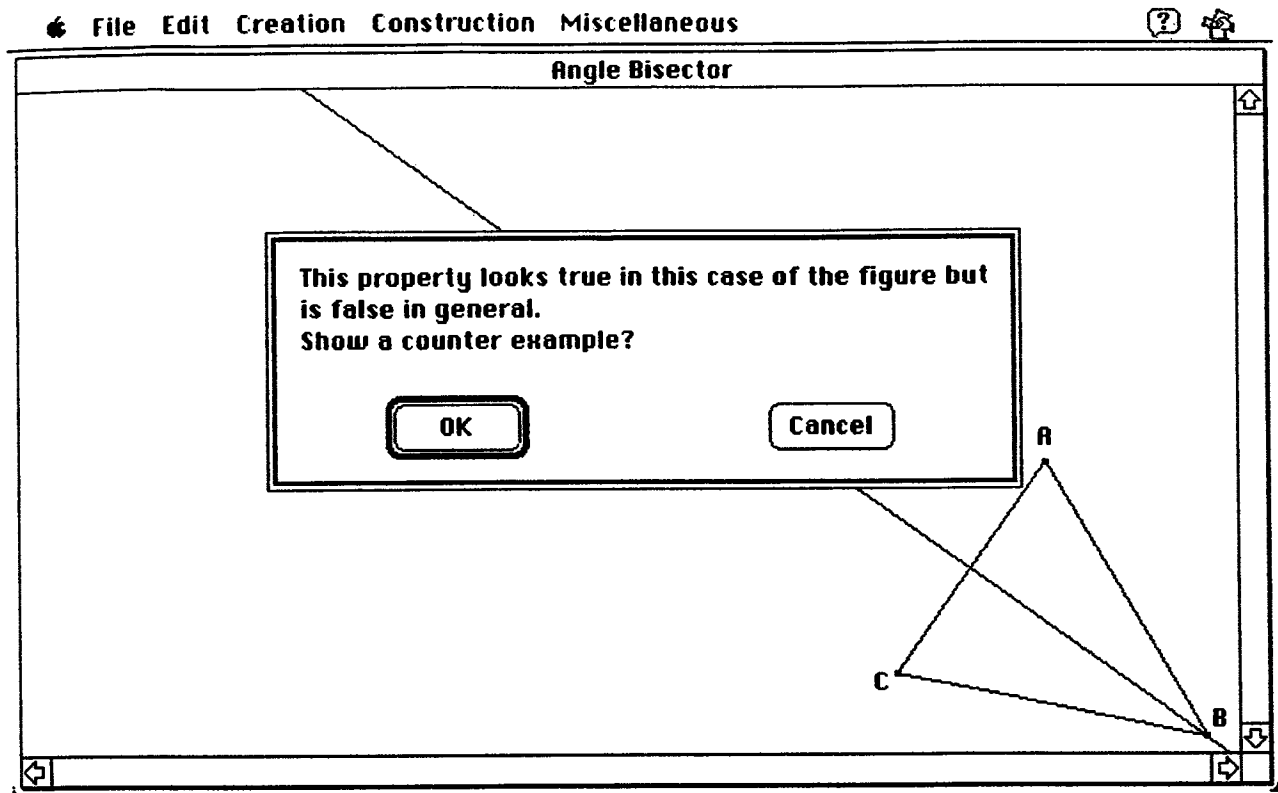


Figure 2. The response of *Cabri-Géomètre* after checking for perpendicularity of segment  $AC$  with the bisector of angle  $ABC$ .

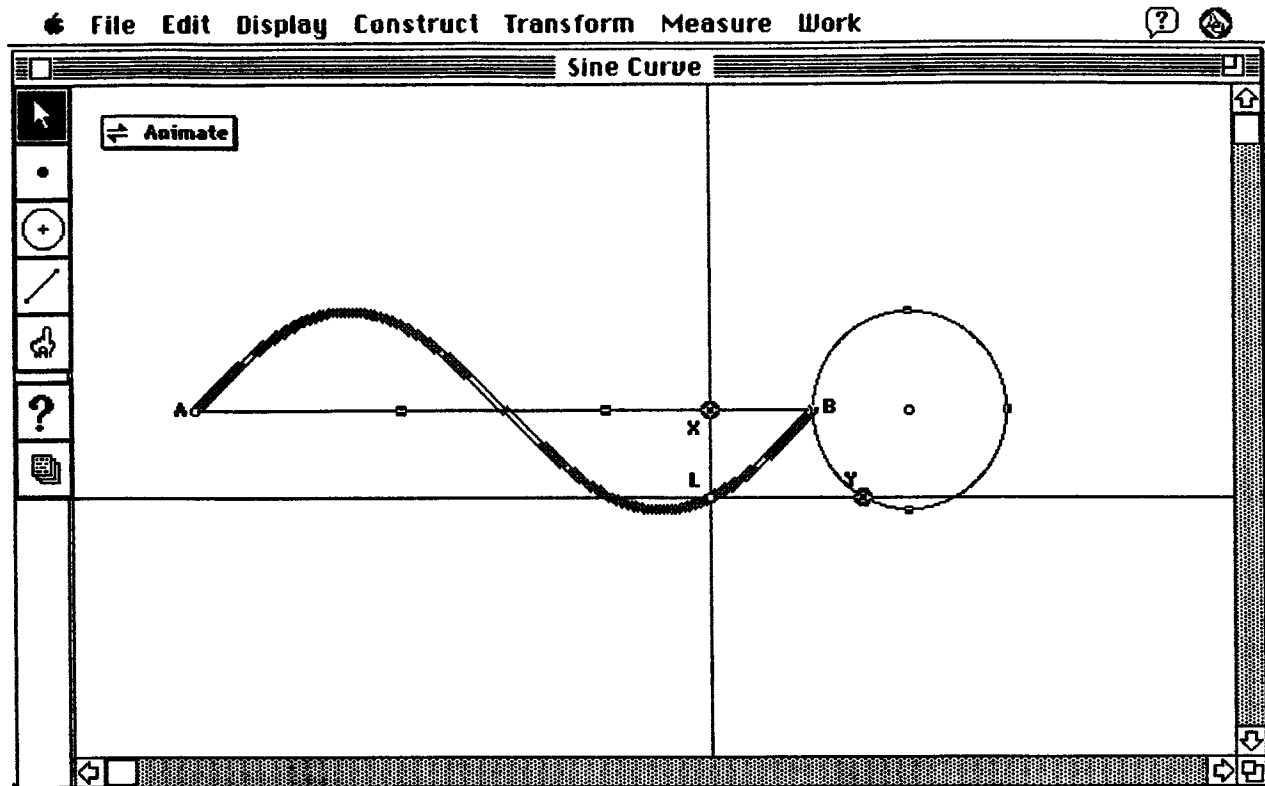


Figure 3. This action button on the *Geometer's Sketchpad* will animate point  $X$  along the segment  $AB$  and  $Y$  along the circle. By tracing the locus of  $L$ , the sine curve is constructed.

Dragging points to make dynamic changes is an essential feature for a DGS. *Sketchpad* will simulate the dragging of a point by automatically moving it along a circle or line segment, thus animating the figure. For example, Figure 3 shows the creation of a sine curve by animation.

In addition to adding text as comments on a sketch, the user can record sounds and leave them as buttons on the sketch to be played at any time. These sounds could be used as comments, suggestions, or whatever creative ideas a student or teacher may come up with.

## (2) Sharing Capabilities

If *Sketchpad* is being used in a Macintosh lab that is networked with AppleTalk, sketches may be transported freely from station to station.

Although *Cabri-Géomètre* and *The Geometer's Sketchpad* have similar features, we have highlighted key differences among the packages. As new DGS's are produced and marketed, manufacturers will assimilate ideas from existing software to develop systems even more powerful than those now available.

## References

[1] National Council of Teachers of Mathematics, *Curriculum and evaluation standards for school mathematics*, Reston, Virginia, 1989.

## The Geometry Forum

Gene Klotz\*  
Swarthmore College

The Geometry Forum is a collection of Internet-accessible newsgroups. This first paragraph will be a refresher course for those who have yet to try such creatures; in the next paragraph we'll begin discussing the Forum in particular. Almost everyone reading this will know about electronic mail, and most will have access to it. The next step up the ladder in social evolution is the mailing list, an invention which distributes e-mail to a list of subscribers. This is fine if you're interested in the topic(s) being discussed and the flow does not exceed your tolerance for mail. At this time the ultimate structure for social electronic communications is the newsgroup. You receive no mail at all but must use newsreading software (there's some in the public domain) to browse through collections of articles which with some newsreaders are segregated by topic ("thread"). Most people find the organization and nonobtrusiveness a decided improvement over mailing lists.

The Geometry Forum is a project in community building and software development sponsored by the National Science Foundation. The community we're trying to build consists of research mathematicians, college teachers, students at all

levels, mathematics educators, school teachers, and everyone else interested in geometry (yes, there are some). The software development has to do with newsreading software that allows sending and receiving symbols and diagrams, the lack of which can make e-mail cumbersome to mathematicians.

At this moment the Forum contains such things as the "all-institute" lectures from this summer's 5-College Regional Geometry Institute. These lectures are intended to appeal to a wide audience and have been written by interested graduate students with the hope that they will promote discussion by those not at the institute. There are also the notes from lectures, panels, and discussions at a conference on software and other visualization tools that was held at the Geometry Center in Minneapolis in July. Again, the idea is to encourage discussion by those not at the conference and to continue the conference discussions as a kind of continuing proceedings.

What you will find on the Forum by the time you read this is anybody's guess—there is a seasonal variation in activity, and at most sites Forum articles are "expired" after a month (if not sooner). All submissions are archived, however, and are available via ftp (even better, by gopher), along with software, longer articles, bibliographies, and anything else we can find of interest which can be stored electronically. One thing you are almost certain to find on the Forum is an article or so by Evelyn Sander, a graduate student with an interest in writing about mathematics, who serves as our liaison with the Geometry Center. She writes interestingly and at a variety of levels. Among other things, she has interviewed visitors to the Center on their research and talked with several different mathematicians about visualizing four-dimensional objects.

The various newsgroups which constitute the Forum are devoted to such things as general announcements; institutes; puzzles; and precollege, college, and research geometry. Geometry research, for example, has so far consisted of queries (and answers) by mathematicians and scientists, some overview articles on research in computer science/mathematics, and some announcements of new results and abstracts. We welcome your involvement in this and our other newsgroups and also your suggestions as to how we could make the Forum of greater service to the mathematics community. (We do repost relevant material from *sci.math* in an effort to provide one-stop Internet geometry shopping.) Do take a look at what's going on in our other newsgroups as well. It's interesting to see what teachers are involved in, for example.

(Of the various groups involved in the Forum, a word must be said about school teachers. They have at least as much need of being able to discuss their work and share problems and solutions as anybody else (some would argue that their needs are much more desperate). However, most teachers in most states lack Internet access. While national solutions will be along any year now, college and university faculty reading this can render a potentially useful service to education by assisting a local teacher obtain an account at your institution. The incremental cost is negligible, it won't overload your system, and once the teacher is on we can provide training.)

\*Gene Klotz is at Swarthmore College and can be reached electronically at [klotz@forum.swarthmore.edu](mailto:klotz@forum.swarthmore.edu).



### Accessing the Forum

You'll need newsreading software. If you need to know about this, either ask knowledgeable colleagues or call us at 800-756-7823 (we're particularly good for Macintosh software). Then, if your local site carries us (look under `geometry.forum`, `geometry.research`, etc.), you can read us as you would other newsgroups.

If your site doesn't carry us, probably the most convenient solution would be to ask your system administrators if they would be willing to "take a feed of the Forum newsgroups". They will want the e-mail address of someone on our end that

they can talk to. Tell them to send e-mail to Phil Brandenberger (`phil@forum.swarthmore.edu`).

If for some reason this doesn't work, write us and tell us about it. We'll explain how to get your newsreader to point to our site instead of your local one. This ranges from easy to impossible, depending on how your system is set up.

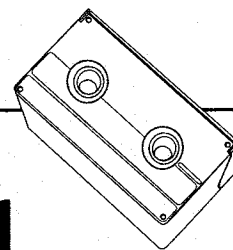
If all else fails, you can subscribe to the Forum newsgroups as mailing lists. We'll tell you how.

Send any questions or comments about accessing the Forum to `annie@forum.swarthmore.edu`.



## VIDEOTAPE

# Interview with I. M. Gelfand



I. M. Gelfand

In this one-hour interview, I. M. Gelfand, one of the major mathematicians of the century, discusses his mathematics, his inspirations, and his major achievements. He also touches on his work in biology and education, two areas in which he has had an important impact. The interview was held during the Joint Mathematics Meetings in Baltimore in January 1992, not long after Gelfand left the former Soviet Union to take a position at Rutgers University. Providing a personal look at this great mathematician, the interview has particular appeal to students, researchers, and historians in mathematics and science. In addition, because Gelfand avoids discussing technical aspects of his work and focuses on what interests and inspires him as a mathematician, this videotape is accessible to a broad audience.

1991 *Mathematics Subject Classification*: 00, 01

ISBN 0-8218-8084-5, NTSC format on 1/2" VHS videotape; approx. 60 minutes, April 1993

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# Inside the AMS

## 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.

### AMS@MATH.AMS.ORG

to contact the administrative offices in Providence. (This address has been changed from EXDIR@MATH.AMS.COM.)

### AMSDC@MATH.AMS.ORG

to contact the Society's office in Washington, DC.

### MEET@MATH.AMS.ORG

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

### AMSMEM@MATH.AMS.ORG

to request information about membership in the AMS, about dues payments, or to ask any general membership questions; may also be used to submit address changes.

### CUST-SERV@MATH.AMS.ORG

to send address changes, place credit card orders for AMS products, or conduct any general correspondence with the Society's Customer Services Department.

### NOTICES@MATH.AMS.ORG

to send correspondence to the Managing Editor of the *Notices*, including letters to the editor, contributed articles, and information for the meetings and conferences listing.

### REPRINT-PERMISSION@MATH.AMS.ORG

to request permission to reprint material from Society publications.

### SECRETARY@MATH.AMS.ORG

to communicate with the Secretary of the Society.

### SUPPORT@e-MATH.AMS.ORG

for information or for assistance in accessing and using e-MATH, the Society's program for electronic services.

### MATHREV@MATH.AMS.ORG

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

### MATHDOC@MATH.AMS.ORG

for users of *Current Mathematical Publications*, *Mathematical Reviews*, and MathSci who wish to order a copy of an original item from the MathDoc document delivery system.

### MATHSCI@MATH.AMS.ORG

for information or questions regarding MathSci. If requesting an information package for MathSci or the T<sub>E</sub>X Library, please include a complete mailing address.

### TRANSL@MATH.AMS.ORG

for general correspondence with the Translations Department.

### GUIDE-ELEC@MATH.AMS.ORG

to request a copy of the Society's *Guidelines for Preparing Electronic Manuscripts*. Please specify  $\text{\AA MS-T}_{\text{E}}\text{X}$  or  $\text{\AA MS-L}_{\text{A}}\text{T}_{\text{E}}\text{X}$  version.

### AMS-TEX@MATH.AMS.ORG

to request the  $\text{\AA MS-T}_{\text{E}}\text{X}$  macro package and documentation.\*

### AMS-LATEX@MATH.AMS.ORG

to request the  $\text{\AA MS-L}_{\text{A}}\text{T}_{\text{E}}\text{X}$  macro package and documentation.\*

### ABS-REQUEST@MATH.AMS.ORG

to request T<sub>E</sub>X style files\* for submission of abstracts for AMS meetings and for MAA programs at January and August Joint Mathematics Meetings.

### ABS-SUBMIT@MATH.AMS.ORG

to submit abstracts for AMS meetings and for MAA programs at January and August Joint Mathematics Meetings.

### ABS-MISC@MATH.AMS.ORG

for questions regarding a particular abstract.

### PUB-SUBMIT@MATH.AMS.ORG

to submit accepted manuscripts to AMS publications (other than *Abstracts*).

### PUB@MATH.AMS.ORG

to send correspondence to the AMS Publication Division.

### TECH-SUPPORT@MATH.AMS.ORG

to contact the Society's Typesetting Technical Support group.

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\*These packages are available via anonymous ftp from e-MATH.AMS.ORG or on diskette. When requesting diskettes please specify either IBM or Macintosh format and give a complete mailing address.

## News and Announcements

### MAA Presents Expository Awards

The Mathematical Association of America (MAA) presented six awards and prizes on August 15, 1993, during the Opening Banquet of the International Joint Mathematics Meetings in Vancouver, British Columbia. The 71st summer meeting of the MAA was being held in conjunction with the Canadian Mathematical Society and the American Mathematical Society, August 15–19, 1993.

The Merten M. Hasse Prize was awarded to JONATHAN M. BORWEIN, PETER B. BORWEIN, and DAVID H. BAILEY for “Ramanujan, modular equations, and approximations to  $\pi$  or how to compute one billion digits of  $\pi$ ” (*The American Mathematical Monthly* **96**, 1989, 201–219). The Hasse prize was established in 1986 to encourage younger mathematicians “to take up the challenge of exposition and communication” where at least one of the authors must be younger than forty years of age.

Jonathan Borwein received his B.A. from the University of Western Ontario and his M.Sc. and D.Phil from Oxford University, where he was a Rhodes Scholar. In 1993 he joined the faculty of Simon Fraser University.

Peter Borwein received his B.Sc. from the University of Western Ontario and his M.Sc. and Ph.D. from the University of British Columbia. He also joined the faculty of Simon Fraser University in 1993.

David H. Bailey received his B.S. in mathematics from Brigham Young University and his Ph.D. in mathematics from Stanford University. He is currently on the staff of the NAS Applied Research Branch at NASA Ames Research Center.

This paper was also awarded the prestigious Chauvenet Prize from the MAA at the January Joint Mathematics Meeting this year in San Antonio, Texas.

The George Pólya Award was presented to LESTER H. LANGE and JAMES W. MILLER for their article “A Random Ladder Game: Permutations, Eigenvalues, and Convergence of Markov Chains” (*College Mathematics Journal* **23**, 1992, 373–385). The Pólya Award was established in 1976 and named after George Pólya, who was a distinguished mathematician, well-known author, and professor at Stanford University. The award is made to authors of expository articles published in the *College Mathematics Journal*.

Professor Lange is Emeritus Professor of Mathematics and Emeritus Dean of Science at San Jose State University and is currently volunteering at the university’s Moss Landing Marine Laboratories. He received his M.A. under George Pólya, followed by a Ph.D. under Wladimir Seidel.

James W. Miller is a Ph.D. student in the Department of Statistical Science at Southern Methodist University in Dallas, Texas. He received a Bachelor of Music Education degree and an M.S. in Applied Mathematics from Baylor University.

A second George Pólya Award was presented to DANA N. MACKENZIE for “Triquetras and Porisms” (*College Mathematics Journal* **23**, 1992, 118–131).

Professor Mackenzie received his Ph.D. from Princeton University and since 1989 has been an assistant professor of mathematics at Kenyon College.

Two Lester R. Ford Awards were presented to DONALD E. KNUTH for

“Two Notes on Notation” (*The American Mathematical Monthly* **99**, 1992, 403–422) and to CARSTEN THOMASSEN for “The Jordan-Schönflies Theorem and the Classification of Surfaces” (*The American Mathematical Monthly* **99**, 1992, 116–130).

Professor Knuth received his B.S. and M.S. from the Case Institute of Technology and his Ph.D. from the California Institute of Technology. He is Professor Emeritus of The Art of Computer Programming at Stanford University.

Professor Thomassen received his master’s degree from Aarhus University, Denmark, and his Ph.D. from the University of Waterloo. He has been a professor of mathematics at the Technical University of Denmark since 1981.

The Ford Award, established in 1964, is made to authors of expository articles published in *The American Mathematical Monthly*. It is named for Lester R. Ford, Sr., a distinguished mathematician, editor of *The American Mathematical Monthly*, and former president of the MAA.

The Carl B. Allendoerfer Award was presented to XUN-CHENG HUANG for “From Intermediate Value Theorem to Chaos” (*Mathematics Magazine* **65**, 1992, 91–103).

Professor Huang received his bachelor’s degree from East China Normal University and his Ph.D. in applied mathematics from Marquette University. He has been on the faculty of the New Jersey Institute of Technology since 1990.

The Allendoerfer Award was established in 1976 and is awarded to authors of expository articles published in *Mathematics Magazine*. Carl B. Allendoerfer

was a distinguished mathematician and former president of the MAA.

### Glimm Receives SIAM Prize

James G. Glimm of the State University of New York at Stony Brook was presented with a special award by the Society for Industrial and Applied Mathematics (SIAM). The award, presented at the SIAM Annual Meeting in Philadelphia in July 1993, commends Glimm "for his leadership and insight in producing 'Mathematical Sciences, Technology, and Economic Competitiveness,' a 1991 report of the National Research Council that documents the importance of quantitative reasoning, including the use of computational models, in solving problems of product and process design and performance by U.S. industry."

### U.S. Wins Six Medals in Olympiad

The U.S. team placed seventh in the 34th International Mathematical Olympiad (IMO) held in July in Istanbul. All six students on the U.S. team won medals, including two gold medals. The top ten teams in order were China, Germany, Bulgaria, Russia, Taiwan, Iran, U.S.A., Hungary, Vietnam, and the Czech Republic.

ANDREW DITTMER of Vienna, Virginia, and LENHARD NG of Chapel Hill, North Carolina, both received gold medals; Ng was also a gold medalist in last year's IMO. WEI-HWA HUANG of North Potomac, Maryland, and STEPHEN WANG of St. Charles, Illinois, each won a silver medal. Bronze medals went to JEREMY BEM of Ithaca, New York, and to TIM CHKLOVSKI of Minneapolis, Minnesota.

Before the IMO the U.S. students participated in a month-long training session at the U.S. Military Academy at West Point. The session was directed by Cecil Rousseau of Memphis State University. Accompanying the team to Istanbul were Rousseau, Walter E. Mientka of the University of Nebraska, Anne Hudson of Armstrong State College, and Titu Andreescu of the Illinois Mathematics and Science Academy. Mientka is the executive director of the American Mathematics Competitions.

The IMO began in 1959, and the U.S. has been sending teams to compete since 1974. The team selection process begins with a sequence of three examinations prepared by the Committee on the American Mathematics Competitions. The first, the American High School Mathematics Examination, is taken by nearly 400,000 students, and the second, the American Invitational Mathematics Examination, is taken by about 4,000 students. About 140 students take the U.S.A. Mathematical Olympiad (USAMO), an essay-proof examination requiring insight and ingenuity. Each year the top scorers on the USAMO are honored in ceremonies held in Washington, DC, at the National Academy of Sciences. Those students and a number of others who did well on the USAMO participate in the summer training session in preparation for the IMO.

### Voronezh Series on Global Analysis

The Voronezh series, *New Developments in Global Analysis*, was published simultaneously in Russian by Voronezh University Press and in English by Springer-Verlag. The Springer-Verlag editions appeared as special issues, entitled "Global Analysis: Studies and Applications", of *Lecture Notes in Mathematics*, edited by Yu. G. Borisovich and Yu. E. Gliklikh (volumes 1108, 1214, 1334, 1453, and 1520). The Voronezh series mainly included research surveys and expository articles in various fields of global analysis and its applications. Recently, Voronezh University Press began publishing this series exclusively in English. The first issue, entitled "Problems of Geometry, Topology, and Mathematical Physics", has already been published and contains papers by Yu. G. Borisovich; Yu. E. Gliklikh; M. Karasev and Yu. Vorobjev; V. N. Karpushkin; V. E. Nazaikinskii, B. Yu. Sternin, and V. E. Shatalov; and V. R. Zachepa.

It is hoped that continuation of this series will help support mathematical publishing in Russia during the difficult economic times there. For further information about the series contact: Yu. E. Gliklikh, Mathematics Faculty, Voronezh State Univer-

sity, 394693, Voronezh, Russia; e-mail: lvin@vucnit.voronezh.su.

### Henri Poincaré Institute Restarts Activities

The Henri Poincaré Institute (IHP) originally opened in 1928 at the University of Paris, with Emile Borel as its first chair. The wealth of the Institute's library, which inherited the collections of G. Darboux and of the old Sorbonne, made the IHP known worldwide. In 1969 the University of Paris split up into several campuses, and the IHP premises fell into disrepair. A decree signed in 1990 by the prime minister of France promoted a revitalization of the IHP.

The renovation of the IHP building includes the Emile Borel International Research Center, the House of Mathematics, the Henri Poincaré Library, and amphitheatres and lecture rooms. The IHP will phase in its reopening between October 1993 and February 1994.

The Research Center will organize yearly or half-yearly programs in mathematics and theoretical physics. The first program, on symplectic geometry, is scheduled to run from February to June 1994, and will be organized by F. Laudenbach and C. Viterbo. There will also be programs on nonlinear waves (fall 1994) and on algebraic curves (spring 1995). The House of Mathematics will accommodate activities of general interest to mathematicians and theoretical physicists. The distinguished Library has been reorganized, updated, and relocated to a larger setting. Open to the general public, its collection focuses on mathematics and theoretical physics, with special emphasis on the history of mathematics and ancient works. The renovated Hermite and Darboux Amphitheatres and new seminar rooms will be used for meetings and seminars of the universities and the Ile de France area, as well as the postgraduate courses of the Borel Center.

Further information is available from: Henri Poincaré Institute, 11 Rue Pierre et Marie Curie, 75231 Paris, Cedex 05, France; telephone: 33-1-40-51-76-03; fax: 33-1-43-25-40-67.

# 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  
202-357-3455  
jryff@nsf.gov

## Modern Analysis

Kevin Clancey  
202-357-3697  
kclancey@nsf.gov

## Geometric Analysis

James Glazebrook  
202-357-3451  
jglazebr@nsf.gov

## Topology and Foundations

Ralph M. Krause  
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rkrase@nsf.gov

## Algebra and Number Theory

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Daniel Madden  
dmadden@nsf.gov  
202-357-3695

## Applied Mathematics

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Michael Steuerwalt  
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202-357-3686

## Computational Mathematics

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msteuerw@nsf.gov  
Alvin Thaler  
athaler@nsf.gov  
202-357-3691

## Statistics and Probability

Keith Crank  
kcrank@nsf.gov  
Alan J. Izenman  
aizenman@nsf.gov  
202-357-3693

## Office of Special Projects

Bernard R. McDonald (Head)  
bmcdonal@nsf.gov

Deborah F. Lockhart  
dlockhar@nsf.gov

Jean Thiebaux  
jthiebau@nsf.gov  
202-357-3453

The administrative staff includes:

## Division Director

Frederic Y. M. Wan  
fwan@nsf.gov  
202-357-9669

## Deputy Division Director

Bernard R. McDonald  
bmcdonal@nsf.gov  
202-357-9669

## Administrative Officer

Tyczer Henson  
thenson@nsf.gov  
202-357-9669

The permanent Division staff consists of Boyle, Krause, Lockhart, McDonald, Ryff, and Thaler. In January 1993 Frederic Wan of the University of Washington at Seattle was appointed as DMS director. An interview with Wan appeared in the July/August 1993 issue of the *Notices*, pages 577-580.

The incoming visiting scientists for the coming year are Daljit Ahluwalia from the New Jersey Institute of Technology, Kevin Clancey from the University of Georgia, and Daniel Madden from the University of Arizona.

Many thanks to outgoing visiting scientists Joe Jenkins of SUNY at Albany; Rouben Rostamian of the University of Maryland, Baltimore County; and William Velez of the University of Arizona.

Adjunct program officers are James Alexander of the University of Maryland, College Park; Gary Cornell of the University of Connecticut at Storrs; Joe Jenkins of SUNY at Albany; and John Lagnese of Georgetown University.

**Please Note:** The NSF will be relocating to a new facility in Arlington, Virginia. The move will commence in September 1993 and extend through early December 1993. Directorate moves are scheduled over the entire transition period, with the Directorate for Mathematical and Physical Sciences relocating on November 5, 1993.

New telephone and fax numbers will

be introduced over the course of the fall, concurrent with the relocation of each directorate. The telephone directory will be updated frequently during this period of transition and will be posted on STIS, NSF's online information service. In addition, calls to the old numbers will be handled automatically with special call features. For a period of several months following the move, calls placed to the old numbers will be intercepted, new number information will be provided, and calls will be forwarded to the new location in Arlington. New telephone numbers for the Division of Mathematical Sciences will be published in the *Notices* when they become available.

The new mailing address, however, will become effective on a one-time basis for the entire Foundation. The official change is concurrent with the relocation of the central Mail Room. Mail service is assured to all Directorates through out the move process, regardless of their location.

Proposals should be sent to the NSF's Proposal Processing Unit. Until October 25, 1993, the address is

Proposal Processing Unit  
National Science Foundation  
Room 223  
1800 G Street, NW  
Washington, DC 20550

After October 25, 1993, the address will be

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

Until November 5, 1993, the location of the DMS is

Division of Mathematical Sciences  
National Science Foundation  
Room 339  
1800 G Street, NW  
Washington, DC 20550

After November 5, 1993, the location of the DMS will be

Division of Mathematical Sciences  
National Science Foundation  
Room 1025  
4201 Wilson Boulevard  
Arlington, VA 22230

The NSF encourages use of e-mail



for communication with NSF personnel over the course of the move, as e-mail addresses will be unaffected by the relocation.

### 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  
202-357-7452

### Teacher Enhancement Program

Peter Braunfeld  
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Henry Kepner  
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### Instructional Materials Development Program

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### Young Scholars Program

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### Division of Research, Evaluation, and Dissemination

#### Research in Teaching and Learning Program

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### Division of Undergraduate Education

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Elizabeth Teles  
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### Office of Systemic Initiatives

Paula Duckett  
pduckett@nsf.gov  
Madeleine Long  
mlong@nsf.gov  
Dorothy Strong  
dstrong@nsf.gov  
202-357-7073

### Office of the Assistant Director for EHR

Lida K. Barrett, Senior Associate for  
Planning, Coordination, and External  
Affairs  
lbarrett@nsf.gov, 202-357-7579

The community expresses its thanks for a job well done to outgoing visiting scientists Marjorie Enneking, Portland State University; James Sandefur, Georgetown University; Ray Collings, Dekalb College; William Geeslin, University of New Hampshire; and Kenneth Travers, University of Illinois.

A number of visiting scientists in mathematics and mathematics education have joined the EHR staff this year. They are: Paula Duckett, DC Public Schools; Henry Kepner, University of Wisconsin at Milwaukee; Richard Lesh, Education Testing Service; Eric Robinson, Ithaca College; Tina Straley, Kennesaw College; Dorothy Strong, Chicago Public Schools; and Rudolfo Tamez, California State University at Los Angeles.

**Please Note:** The NSF will be relocating to a new facility in Arlington, Virginia. The move will commence in September 1993 and extend through early December 1993. Directorate moves are scheduled over the entire transition period. For detailed information on the move, see the note on the previous page. After October 25, 1993, the new mailing address for EHR will be

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 the Proposal Processing Unit at the addresses on page 997. 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.

### 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 Mathematical and Computer Sciences AFOSR/NM

110 Duncan Avenue  
Suite B115  
Bolling AFB, DC 20332-0001  
Fax: 202-404-7496  
Charles J. Holland, Director  
202-767-5025  
e-mail: holland@afosr.af.mil

### Optimization and Discrete Mathematics

Neal D. Glassman  
202-767-5026

### Physical Mathematics and Applied Analysis

Arje Nachman  
202-767-4939

### Electromagnetics

Arje Nachman  
202-767-4939

### Artificial Intelligence

Abraham Waksman  
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### Signal Processing, Probability, and Statistics

Jon A. Sjogren  
202-767-4940  
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### Computational Mathematics

Marc Jacobs  
202-767-5027

### Software and Systems

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suddarth@afosr.af.mil

*Dynamics and Control*  
Marc Jacobs  
202-767-5027

*Neural Computation Systems*  
Steve Suddarth  
202-767-5028  
suddarth@afosr.af.mil

**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  
Gerald Andersen, Associate Director

*Applied Analysis and Physical  
Mathematics*  
Julian Wu  
919-549-4332

jjuwu@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*  
Gerald Andersen  
919-549-4253  
andersen@brl.mil

*Systems and Control; Centers of  
Excellence*  
Jagdish Chandra  
919-549-4254  
chandra@aro-emh1.army.mil

*Workshops, Army-wide Conferences,  
Tutorials, and Special Projects*  
Francis Dressel  
919-549-4319

**Advanced Research Projects Agency**  
Applied and Computational  
Mathematics Program

3701 North Fairfax Drive  
Arlington, VA 22203-1714  
James Crowley, Program Manager  
703-696-2287  
jcrowley@arpa.mil

**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

**Office of Naval Research**  
Mathematics Division  
Code 311  
800 North Quincy Street  
Arlington, VA 22217  
Neil Gerr, Director  
703-696-4321  
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Richard Lau  
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*Applied Analysis*  
Reza Malek-Madani  
703-696-4314  
rmm@onr-hq.navy.mil

**News from the  
Mathematical Sciences  
Research Institute  
Berkeley, California**

***Fermat Fever***

The Mathematical Sciences Research Institute (MSRI) was caught up in the general excitement surrounding the an-

nouncement of the proof of Fermat's Last Theorem by Andrew Wiles. A joint presentation by MSRI and the Exploratorium in San Francisco attracted an enthusiastic audience of over 1000. (See also page 982 for an article on this presentation.) A videotape of the event is being prepared. Details can be found in an advertisement elsewhere in this issue.

***Mathematical Sculpture***

A sculpture by Helaman Ferguson has just been installed at MSRI. It is based on a famous maximally-symmetric Riemann surface known as the Klein curve. There will be an official dedication ceremony in the future, probably in November. For more information write MSRI at 1000 Centennial Drive, Berkeley, CA 94720; or send e-mail to sculpture@msri.org.

***Human Resources Initiative***

As announced in the July/August issue of the *Notices* (p. 645), MSRI has launched a program of actively seeking mathematicians from underrepresented minorities. There is still some support available for short visits during the current academic year, and we will also accept applications for 1994-1995. Write to William P. Thurston, Director, MSRI, at the address above, or send e-mail to hr@msri.org.

***Future Programs***

Applications for Postdoctoral Fellowships and General Memberships for 1994-1995 are due by **November 30, 1993**. There will be a full-year program on automorphic forms, and a half-year program in the spring on complex dynamics and hyperbolic geometry. For more information please see page 550 of the May/June *Notices* or send e-mail to info@msri.org with the message: help.

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

The Army Research Office will support several 1993-1994 postdoctoral fellows at the Mathematical Sciences Institute

of Cornell University in the areas of stochastic analysis, symbolic methods in algorithmic mathematics, and the mathematics of nonlinear systems. One position is reserved for women and minority applicants. For application procedures see the "Stipends for Study" section elsewhere in this issue.

The U.S.-Italian conference on Hilbert Functions will meet October 27–30, 1993, at MSI. Contact B. Sturmfels, bernd@math.cornell.edu, for information.

ANTS-1, the first symposium on algebra and number theory, will meet at Cornell University from May 7–10, 1994. Contact Len Adleman, adleman@cs.usc.edu, for information.

A conference in honor of E. Dynkin of Cornell University will be held at MSI from May 22–24, 1994. Contact H. Kesten at hak@cornell.bitnet for information.

MSI Director A. Nerode is the program chair for LFCS'94: Logic at St. Petersburg, a symposium on logical foundations of computer science to be held July 14–18, 1994, in St. Petersburg, Russia. Contact V. Marek at marek@ms.uky.edu.

A. Nerode of MSI and V. Marek from the University of Kentucky are co-general chairs for the 1994 International Symposium on Logic Programming to meet November 13–17, 1994, in Ithaca, New York. For information contact V. Marek at marek@ms.uky.edu.

### Mathematics Awareness Week 1994

Each year Mathematics Awareness Week provides an opportunity to communicate to the general public about the beauty and importance of mathematics. Over the years the event has spawned a wide range of local and national public out-

reach activities. In 1994 Mathematics Awareness Week will be held April 24–30 and will focus on the theme "Mathematics and Medicine". Mark your calendar now and plan to observe Mathematics Awareness Week in your community, school, or department. Over the coming months watch for further information from the Joint Policy Board for Mathematics, the national sponsor for Mathematics Awareness Week.

### Erratum

Because of incomplete information supplied to the *Notices*, the announcement of the 1993 Wolf Prizes (May/June 1993 issue) incompletely described the affiliation of Mikhail Gromov. In addition to his position at the Institut des Hautes Etudes Scientifiques, Gromov holds a faculty position at the University of Maryland, College Park.

## Call for Nominations for the D.R. Fulkerson Prize

This is a call for nominations for the Delbert Ray Fulkerson Prize in discrete mathematics that will be awarded at the XVth International Symposium on Mathematical Programming to be held in Ann Arbor, Michigan, U.S.A., August 15–19, 1994. The Fulkerson Prize is awarded jointly by the Mathematical Programming Society and the American Mathematical Society.

The specifications for the Fulkerson Prize read:

"Papers to be eligible for the Fulkerson Prize should have been published in a recognized journal during the six calendar years preceding the year of the Congress. The extended period is in recognition of the fact that the value of fundamental work cannot always be immediately assessed. The prizes will be given for single papers, not a series of papers or books, and in the event of joint authorship the prize will be divided."

"The term 'discrete mathematics' is intended to include graph theory, networks, mathematical programming, applied combinatorics, and related subjects. While research work in these areas is usually not far removed from practical applications, the judging of papers will be based on their mathematical quality and significance."

The nominations for the award will be presented by the Fulkerson Prize Committee (Alexander Schrijver, Chairman; Alan J. Hoffman; Éva Tardos) to the Mathematical Programming Society and the American Mathematical Society.

Please send your nominations by **January 15, 1994**, to:

Alexander Schrijver  
CWI  
Kruislaan 413  
1098 SJ Amsterdam, The Netherlands

# Funding Information for the Mathematical Sciences

## **AMS Centennial Fellowships Invitation for Applications, 1994–1995**

**Deadline: December 1, 1993**

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, 1982, and December 31, 1987, 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 1994–1995 has been set by the Trustees of the Society at \$42,600 for nine months. In addition there will be an expense allowance of \$1,400. 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 several years.

The deadline for receipt of applications is **December 1, 1993**. 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](mailto: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.)

## **NSA Sabbatical Program**

The National Security Agency (NSA) has a program supporting sabbaticals for academic mathematical scientists to visit NSA, usually for nine to twelve months. In addition to a supplement to the university's stipend to bring the visitor's salary up to his or her regular monthly salary, a choice is offered of either an allowance for moving expenses or a housing supplement. American citizenship for the applicant and all immediate family members is required. Because a complete background investigation is required, applications for 1994–1995 should be submitted as soon as possible.

For further information on the sabbatical program contact: Dr. Charles F. Osgood, Director, Mathematical Sciences Program, National Security Agency, ATTN: R51A, Ft. George G. Meade, MD 20755-6000; 301-688-0400; e-mail: [msp@titan1.math.umbc.edu](mailto:msp@titan1.math.umbc.edu).

# Proposed Amendment to the Bylaws of the American Mathematical Society

**Erratum:** The September 1993 issue of the *Notices*, pages 830–831, contained a proposed amendment to the Bylaws of the American Mathematical Society. Due to an error in the typesetting process, the September issue contained sections of text that were to be set in italics but were actually printed in bold face italics. One of the affected sections was the proposed amendment to the Bylaws. In the statement of the amendment, words to be inserted were to be set in bold face type. Because of the error, some text which is currently in the Bylaws appeared to be text that was to be added. A corrected version of the proposed amendment is reproduced below. The statement of the proposed amendment which was mailed with the ballot is correct.

The Council has adopted several changes in the manner in which policy matters are funnelled through the Society's governance structure. In particular it has established policy committees in several areas. (Information about these changes has appeared in various issues of the *Notices* during the past year.) The Council then examined the question of membership on the Council of the chair of the Committee on Science Policy and the chair of the Committee to Monitor Problems in Communication. The Council recommended the elimination of this second committee (to be replaced by the policy Committee on Publication).

In order to affect these changes it is necessary to change the Bylaws of the Society. The Council has passed the amendment to the Bylaws noted below and submits it to the membership for ratification in the Election of 1993. The effect of this amendment is to eliminate any mention in the Bylaws of the Committee to Monitor Problems in Communication and the Committee on Science Policy. If this amendment is passed, members of the Council will consist of the officers (a total of nine, five of whom are elected in contested elections), nine chairs of editorial committees (appointed by the Council), fifteen Members-at-Large elected in contested elections, and, when applicable, members of the Executive Committee whose terms on the Council have been extended and a former Secretary. Thus there will be twenty members elected in contested elections and thirteen members (on average) elected by the Council itself.

The Bylaws of the Society state the following concerning amendments to the Bylaws:

These Bylaws may be amended or suspended on recommendation of the Council and with the approval of the membership of the Society, the approval consisting of an affirmative vote by two-thirds of the members present at a business meeting or of two-thirds of the members voting in a mail ballot in which at least ten percent of the members vote, whichever alternative shall have been designated by the Council, and provided notice of the proposed action and of its general nature shall have been given in the call for the meeting or accompanies the ballot in full.

In the statement of the amendment, deleted words are ~~lined out~~ and insertions are in **bold face**.

The ballot on the amendment is on the same sheet as that for officers and Council members.

## Article III Committees

**Section 1.** There shall be nine editorial committees as follows: committees for the *Bulletin*, for the *Proceedings*, for the *Colloquium Publications*, for the *Journal*, for *Mathematical Surveys and Monographs*, for *Mathematical Reviews*; a joint committee for the *Transactions* and the *Memoirs*; a committee consisting of the representatives of the Society on the Board of Editors of the *American Journal of Mathematics*; and a committee for *Mathematics of Computation*.

~~Section 2. There shall be a Science Policy Committee.~~

~~Section 3. There shall be a communications committee called the Committee to Monitor Problems in Communication.~~

**Section 2.** The size of each committee shall be determined by the Council.

## Article IV Council

**Section 1.** The Council shall consist of fifteen members-at-large and the following *ex officio* members: the officers of the Society specified in Article I, except that it shall

include only one associate secretary, the chairman of each of the editorial committees **specified in Article III and of the communications committee and of the Science Policy Committee**, any former secretary for a period of two years following the terms of office, and members of the Executive Committee (Article V) who remain on the Council by the operation of Article VII, Section 4.

## Article VI

### *Executive Director*

**Section 3.** The Executive Director shall work under the immediate direction of a committee consisting of the president, the secretary, and the treasurer, of which the president shall be chairman *ex officio*. The Executive Director shall attend meetings of the Board of Trustees, the Council, and the Executive Committee, but shall not be a member of any of these bodies. ~~The Executive Director shall be a voting member~~

~~of the Committee to Monitor Problems in Communications but shall not be its chairman.~~

## Article VII

**Section 2.** Each committee named in Article III, ~~Section 1 or 3~~, shall be appointed by the Council in a manner designated by the Council.

## Article XII

### *Communications*

~~The Committee to Monitor Problems in Communication shall perform such tasks in the field of communication of mathematics as are assigned to it by the Council.~~

(Article XII will be deleted and the remaining articles numbered accordingly.)

## Translations of Mathematical Monographs

### Complexity of Proofs and Their Transformations in Axiomatic Theories

V. P. Orevkov

Volume 128

This work develops a tool of logical deduction schemata and uses it to establish upper and lower bounds on the complexity of proofs and their transformations in axiomatized theories. The main results are: establishment of upper bounds on the elongation of deductions in cut eliminations; a proof that the length of a direct deduction of an existence theorem in the predicate calculus cannot be bounded above by an elementary function of the length of an indirect deduction of the same theorem; a complexity version of the existence property of the constructive predicate calculus; and, for certain formal systems of arithmetic, restrictions on the complexity of deductions that guarantee that the deducibility of a formula for all natural numbers in some finite set implies the deducibility of the same formula with a universal quantifier over all sufficiently large numbers.

1991 *Mathematics Subject Classification*: 03

ISBN 0-8218-4576-4, 153 pages (hardcover), September 1993

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# 1993 AMS Election

## Candidates

### OFFICERS

#### President-Elect (one to be elected)

Hyman Bass

Cathleen S. Morawetz

#### Vice-President (one to be elected)

Jerry L. Bona

Jean E. Taylor

Ramesh A. Gangolli

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

Edward Bierstone

Donald St.P. Richards

James W. Cannon

Norberto Salinas

Dennis DeTurck

Sylvia M. Wiegand

Robert K. Lazarsfeld

Robert J. Zimmer

Frank Morgan

#### Board of Trustees (one to be elected)

D. J. Lewis

Marc A. Rieffel

### NOMINATING COMMITTEE FOR 1994

(Three to be elected)

Morris W. Hirsch

Seymour Schuster

Hugh L. Montgomery

Charles C. Sims

Linda Preiss Rothschild

Chuu-Lian Terng

### EDITORIAL BOARDS COMMITTEE FOR 1994

(Two to be elected)

J. Brian Conrey

Carolyn S. Gordon

Martin Golubitsky

Carl Pomerance

## Election Information

The ballots for election of members of the Council and Board of Trustees of the Society for 1994 will be mailed on or shortly after September 10, 1993, in order for members to receive their ballots well in advance of the November 10, 1993, deadline. Prior to casting their ballots 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, sections 1, 2, 3; article IV, sections 1, 2, 4; article VII, sections 1, 2, 5. The complete text of the Bylaws appears on pages 1179–1182 of the November 1991 issue of the *Notices*. A list of the members of the Council and Board of Trustees serving terms during 1993 appears on pages 936–937 of the September issue of the *Notices*.

## REPLACEMENT BALLOTS

This year ballots for the AMS election will be mailed September 10, 1993, or within a day or two thereafter. The deadline for receipt of ballots is November 10, 1993.

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, 1993, 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 1994 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, 1995. See pages 936–937 of the September issue of the *Notices* 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 1994 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, 1993**.

# Texas A&M University, College Station, Texas

## October 22–23, 1993

### *Preliminary Program*

The eight hundred and eighty-sixth meeting of the American Mathematical Society (AMS) will be held on the campus of Texas A&M University, College Station, Texas, on Friday, October 22, and Saturday, October 23, 1993. All sessions will be held in Rudder Tower. The invited addresses will be in Room 601, Rudder Tower.

#### *Invited Addresses*

**Steven P. Lally**, Purdue University, *Symbolic dynamics, probability, and counting problems in geometry*, 11:50 a.m., Friday;

**Gilles Pisier**, University of Paris VI and Texas A&M University, *Hilbertian operator spaces*, 1:30 p.m., Friday;

**Theodore A. Slaman**, University of Chicago, *title to be announced*, 11:00 a.m., Saturday;

**Stephen A. Stolz**, University of Notre Dame, *Nonconnected moduli spaces of positive sectional curvature metrics*, 1:30 p.m., Saturday.

#### *Special Sessions*

*Harmonic analysis and its applications*, **Josefina Alvarez**, New Mexico State University;

*Several complex variables*, **Harold P. Boas**, **Al Boggess**, and **Emil J. Straube**, Texas A&M University, College Station;

*Composition operators on spaces of analytic functions*, **Randall K. Campbell-Wright**, University of Tampa; **Carl C. Cowen**, Purdue University; and **Barbara D. MacCluer**, University of Richmond;

*Nonlinear partial differential equations*, **Alfonso Castro**, **Joseph A. Iaia**, **John W. Neuberger**, and **Henry A. Warchall**, University of North Texas;

*Control systems governed by partial differential equations*, **Goong Chen** and **Jianxin Zhou**, Texas A&M University, College Station;

*Texas geometry and topology*, **Tim D. Cochran**, Rice University; **Lorenzo A. Sadun**, University of Texas at Austin; and **Philip B. Yasskin**, Texas A&M University, College Station;

*Reaction diffusion systems*, **William E. Fitzgibbon**, University of Houston, and **J. J. Morgan**, Texas A&M University, College Station;

*Nonselfadjoint operator algebras*, **David R. Larson**, Texas A&M University, College Station;

*Representation theory and geometry of noncommutative algebras*, **Edward S. Letzter**, Texas A&M University, College Station;

*Identities and varieties of algebraic structures*, **John C. Meakin**, University of Nebraska-Lincoln; **Amitai Regev**,

Pennsylvania State University, University Park; **Mark V. Sapid**, University of Nebraska-Lincoln; and **Samuel M. Vovsi**, Trenton State College;

*Noncommutative differential geometry*, **Efton L. Park**, Texas Christian University;

*The geometry of Banach spaces and operator spaces*, **Gilles Pisier** and **Thomas Schlumprecht**, Texas A&M University, College Station;

*Algebraic combinatorics*, **Sung Yell Song**, Iowa State University, and **Paul M. Terwilliger**, University of Wisconsin, Madison.

The sessions on *Several complex variables*, *Control systems governed by partial differential equations*, *Texas geometry and topology*, *Reaction diffusion systems*, *Nonselfadjoint operator algebras*, *Representation theory and geometry of noncommutative algebras*, and *The geometry of Banach spaces and operator spaces* are dedicated to the memory of Ilya Bakelman, professor of mathematics at Texas A&M University and formerly chair professor and head of the geometry section at Leningrad Pedagogical University, who died unexpectedly last year.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

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

#### *Registration*

The meeting registration desk will be located in the second floor reception area of Rudder Tower and will be open from 8:00 a.m. to 5:00 p.m. on Friday and 8:00 a.m. to noon on Saturday. The registration fees are \$30 for members of the AMS; \$45 for nonmembers; and \$10 for emeritus members, students, or unemployed mathematicians.

#### *Events of Other Organizations*

The Department of Mathematics of Texas A&M University is holding a symposium in memory of Ilya Bakelman on October 24 and 25. Invited speakers include Emile Bertin, Luis Caffarelli, Eugene Fabes, Robert Finn, Robert Hardt, Robert Jensen, Vladimir Olikier, William Perry, James Serrin, Michael Solomyak, and Neil Trudinger. The symposium will be held at the College Station Hilton Hotel and Conference Center on Sunday, October 24, from 12:30 p.m. to 5:00 p.m. and on Monday, October 25, from 9:00 a.m. to 5:00 p.m. There will be a symposium banquet Sunday evening, October 24, at the Hilton. Tickets are \$25. Participants are asked to submit the banquet fee and requests for further

## Meetings

information to Steven Taliaferro, Department of Mathematics, Texas A&M University, College Station, TX 77843-3368; e-mail: [memorial@math.tamu.edu](mailto:memorial@math.tamu.edu); or phone: 409-845-3368. Accommodations are available at the sites listed elsewhere in this announcement (participants should mention *Bakelman Memorial Conference* when making reservations for this symposium).

### Accommodations

Rooms have been blocked for participants at the Hilton Hotel, Comfort Inn, and the Hampton Inn. All three hotels offer shuttle service to and from Easterwood Airport. Participants should make their own arrangements with the hotel of their choice and ask for the AMS conference rate. All rates are subject to applicable tax. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

#### College Station Hilton and Conference Center

801 University Drive East, College Station, TX 77840  
Telephone: 409-693-7500 or 800-766-1529  
Single \$59                      Double \$65

#### Comfort Inn

104 South Texas Avenue, College Station, TX 77840  
Telephone: 409-846-7333  
Single \$37                      Double \$42  
Rates include complimentary continental breakfast.

#### Hampton Inn

320 South Texas, College Station, TX 77840  
Telephone: 409-846-0184 or 800-HAMPTON  
Single or Double \$46

### Food Service

The Memorial Student Center adjacent to Rudder Tower offers a variety of cafeteria-style food services on a cash basis. There are several restaurants within walking distance of the campus.

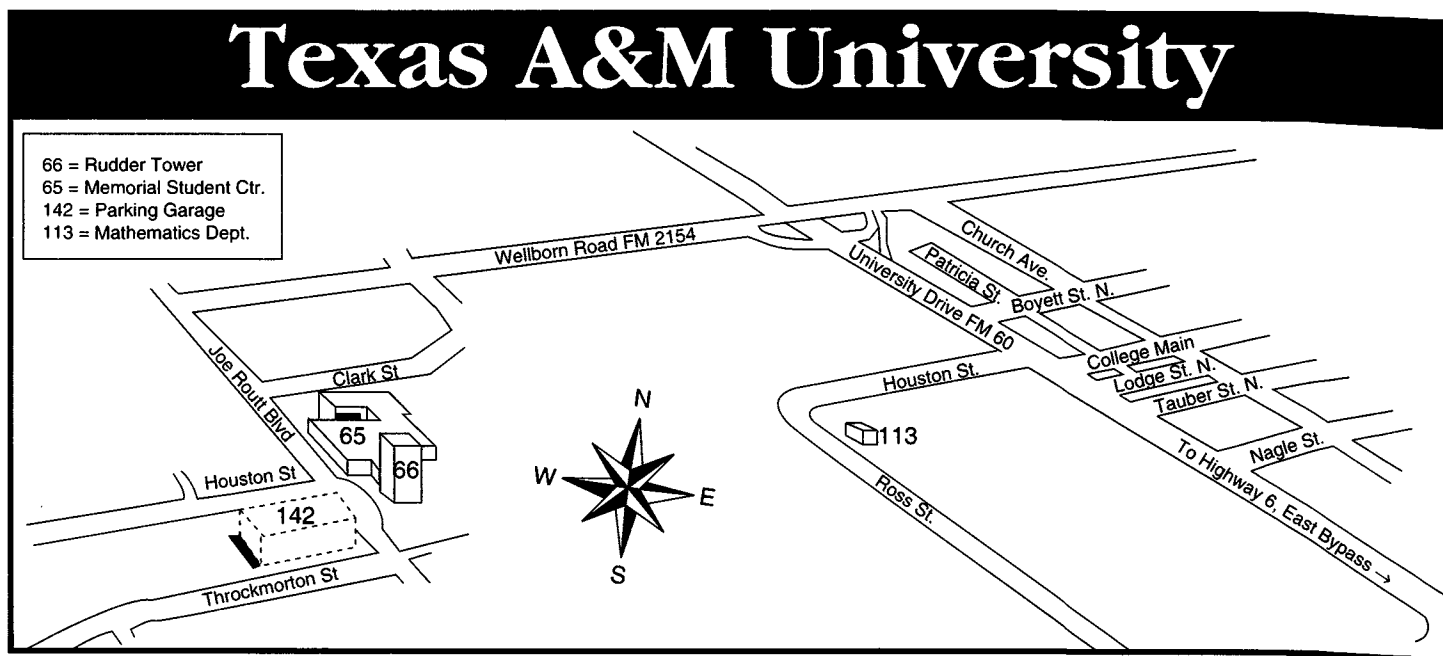
### Parking

There is a parking garage located directly across from Rudder Tower which charges \$1 per hour or \$4 per day. There is usually ample free parking on Saturday.

### Travel and Local Information

University-owned Easterwood Airport in College Station provides services by American Eagle, Atlantic Southeast Airlines, and Continental Express. Continental has been declared the official airline for this meeting. Special airfares include a 40% discount off the full "Y" or "F" class fares or a 5% discount off restricted round trip fares. Please call Continental at 1-800-468-7022 Monday through Friday, 6:00 a.m.–11:59 p.m., and Saturday and Sunday, 8:00 a.m.–9:00 p.m., for reservations and details on applicable restrictions, if any. Refer to Easy Access Number ZMW17. Once reservations have been made, tickets may be purchased from any licensed travel agent, Continental ticket office, or airport ticket counter.

Rental cars and taxi service are available at the airport.



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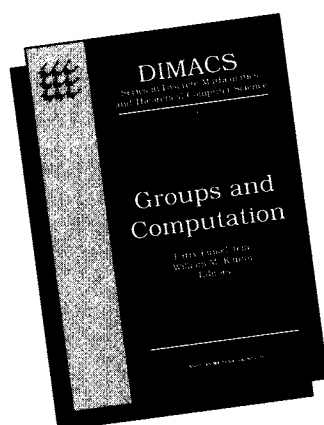
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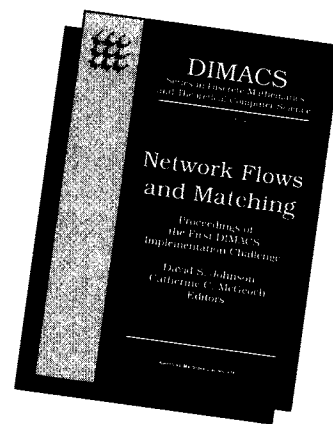
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# Program of the Sessions

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 1993 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.

## Friday, October 22

### Special Session on Harmonic Analysis and its Applications, I

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Weighted estimates for operators related to Fourier transforms*. Preliminary report.  
(1) **C. Carton-Lebrun**, Université de Mors, Belgium (886-42-42)
- 9:00 a.m. *Weighted Fourier transform inequalities via mixed norm Hausdorff-Young inequalities*.  
(2) **Joseph D. Lakey**, University of Texas, Austin (886-42-115)
- 9:30 a.m. *Calderon-Zygmund operator theory and Calderon-type recording formula*. Preliminary report.  
(3) **Y.S. Han**, Auburn University, Auburn (886-42-92) (Sponsored by Josefina Alvarez)
- 10:00 a.m. *Endpoint estimates for commutators with singular integral operators*.  
(4) **Carlos Pérez**, University Autonoma de Madrid, Spain (886-42-10) (Sponsored by Josefina Alvarez)
- 10:30 a.m. *On the Riesz transforms for Gaussian measures*.  
(5) **Cristian E. Gutierrez**, Temple University, Philadelphia (886-42-28)

### Special Session on Reaction Diffusion Systems, I

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *An Eulerian-Lagrangian localized adjoint method for reactive transport with biodegradation*.  
(6) **Richard E. Ewing\***, **Hong Wang**, Texas A & M University, College Station, and **Michael A. Celia**, Princeton University (886-35-236)
- 9:00 a.m. *Three-dimensional bioremediation modeling in heterogeneous porous media*.  
(7) **Mary F. Wheeler**, Rice University (886-35-194)
- 9:30 a.m. *Functional reaction-diffusion equations from climate modeling*. Preliminary report.  
(8) **Georg Hetzer**, Auburn University, Auburn (886-35-24)
- 10:00 a.m. *About global existence for a class of reaction-diffusion systems with balance law*.  
(9) **Michel Pierre**, University of Nancy I, France (886-35-108) (Sponsored by John L. Morgan)

- 10:30 a.m. *Beyond blowup*.  
(10) **Jerrold W. Bebernes**, University of Colorado, Boulder (886-35-151) (Sponsored by William E. Fitzgibbon)

### Special Session on Identities and Varieties of Algebraic Structures, I

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *On identities of some direct limits of hyperbolic groups*.  
(11) **Alexander Yu. Olshanskii**, Moscow State University, Russia (886-20-211) (Sponsored by Samuel M. Vovsi)
- 9:00 a.m. Informal Discussion
- 9:30 a.m. *Latest on the dimension subgroup problem*.  
(12) Preliminary report.  
**Narain Gupta**, University of Manitoba (886-20-73)
- 10:00 a.m. *The Burnside problem on periodic groups*.  
(13) **Sergei V. Ivanov**, McGill University (886-20-210) (Sponsored by Samuel M. Vovsi)
- 10:30 a.m. *Residual properties of free groups*.  
(14) **Thomas S. Weigel**, University of Freiburg, Germany (886-20-190)

### Special Session on Algebraic Combinatorics, I

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Orthogonal arrays, covering designs and search designs*.  
(15) **N. J. A. Sloane**, American Tel & Tel Bell Laboratories, Murray Hill, New Jersey (886-05-122)
- 9:00 a.m. *Orbital schemes of  $B_3(q)$  acting on 2-dimensional totally isotropic subspaces*.  
(16) **J. Hemmeter\***, Northeast Missouri State University, V. A. **Ustimenko**, Kiev State University, Ukraine, and A. J. **Woldar**, Villanova University (886-05-188)
- 9:30 a.m. *Rational functions and association scheme parameters*.  
(17) **Douglas A. Leonard**, Auburn University, Auburn (886-05-97)
- 10:00 a.m. *Extending Lander's table— to nonabelian difference sets*.  
(18) **Ken W. Smith**, Central Michigan University (886-05-94)
- 10:30 a.m. *5-design with three intersection numbers*.  
(19) **Y. J. Ionin** and **M. S. Shrikhande\***, Central Michigan University (886-05-96)



## Friday, October 22 (cont'd)

### Special Session on Several Complex Variables, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *On translations of the images of analytic maps.*  
(20) **Ian Graham\*** and **Dror Varolin**, University of Toronto (886-32-67)
- 9:30 a.m. *Upper semicontinuity of automorphism groups.*  
(21) **Buma Fridman**, Wichita State University (886-32-169)
- 10:00 a.m. *Higher order Kobayashi metrics.* Preliminary report.  
(22) **Jiye Yu**, Texas A & M University, College Station (886-32-68)
- 10:30 a.m. *Subelliptic estimates on non-pseudo convex domains.*  
(23) **Lop-Hing Ho**, Wichita State University (886-32-37)  
(Sponsored by Ziqi Sun)

### Special Session on Composition Operators on Spaces of Analytic Functions, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Geometric models and compactness of composition operators.*  
(24) **Wayne Smith**, University of Hawaii, Honolulu, **Joel H. Shapiro**, Michigan State University, and **David A. Stegenga\***, University of Hawaii, Honolulu (886-30-191)
- 9:30 a.m. *Unitarily equivalent compact composition operators.*  
(25) **Randall K. Campbell-Wright**, University of Tampa (886-47-34)
- 10:00 a.m. *An integral operator on  $H^2$ .* Preliminary report.  
(26) **Alexandru Aleman**, Fern University, Germany, and **Aristomenis G. Siskakis\***, Aristotle University of Thessaloniki, Greece (886-47-126)
- 10:30 a.m. *Composition operators and other operators on Bergman spaces.* Preliminary report.  
(27) **Daniel H. Luecking**, University of Arkansas, Fayetteville (886-46-164)

### Special Session on Partial Differential Equations, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *On the determination of potentials without bound state data.*  
(28) **William Rundell\***, Texas A & M University, College Station, and **Paul Sacks**, Iowa State University (886-35-102)
- 9:30 a.m. *Kernel asymptotics of exotic second-order operators.*  
(29) **Stephen A. Fulling**, Texas A & M University, College Station (886-47-85)
- 10:00 a.m. *Continuous families with a bounding function.* Preliminary report.  
(30) **David Gurney**, Southern Louisiana University (886-35-05)

- 10:30 a.m. *Finite element solutions for models involving the  $p$ -Laplacian.* Preliminary report.  
(31) **Lew Lefton\*** and **Dongming Wei**, University of New Orleans (886-35-71)

### Special Session on Nonself-adjoint Operator Algebras, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Cyclic and separating vectors for extensions of operators.*  
(32) **David R. Larson**, Texas A & M University, College Station, and **Warren R. Wogen\***, University of North Carolina, Chapel Hill (886-47-49)
- 9:30 a.m. *When are close CSL algebras similar?*  
(33) **David R. Pitts**, University of Nebraska, Lincoln (886-47-242)
- 10:00 a.m. *Spectrally bounded generalized inner derivations.*  
(34) **Raul E. Curto**, University of Iowa (886-46-147)
- 10:30 a.m. *Factorization of positive invertible operators in AF algebras.*  
(35) **Houben Huang**, University of Saskatchewan, and **Timothy D. Hudson\***, University of Waterloo (886-46-78)

### Special Session on Representation Theory and Geometry of Non-commutative Algebras, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Differential operators on Toric varieties.*  
(36) **Ian M. Musson**, University of Wisconsin, Milwaukee (886-16-64)
- 9:30 a.m. *Twisted rings of differential operators over projective rational curves.*  
(37) **David T. Kausch**, University of Michigan, Ann Arbor (886-16-181)
- 10:00 a.m. *The coradical filtration of quantum enveloping algebras.*  
(38) **William Chin\***, DePaul University, and **Ian M. Musson**, University of Wisconsin-Milwaukee (886-16-79)
- 10:30 a.m. *On crossed products and invariants of Hopf algebras.*  
(39) **Maria E. Lorenz\***, University of Pittsburgh, Pittsburgh, and **Martin Lorenz**, Temple University, Philadelphia (886-16-157)

### Special Session on The Geometry of Banach Spaces and Operator Spaces, I

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Banach spaces for which all subspaces have LUST.* Preliminary report.  
(40) **Peter Casazza\***, University of Missouri, Columbia, **Bernard Maurey**, University of Paris VII, France, and **Nicole Tomczak-Jaegermann**, University of Alberta (886-46-184)
- 9:30 a.m. *Operator ideals and operator spaces.*  
(41) **B. Mathes\***, Colby College, and **V. Paulsen**, University of Houston-University Park (886-47-251)

- 10:00 a.m. *The complete continuity property and finite dimensional decompositions.*  
(42) **Maria Girardi\***, University of South Carolina, Columbia, and **W. B. Johnson**, Texas A & M University, College Station (886-46-250)
- 10:30 a.m. *On some properties of  $\ell_p$ -tensor products.*  
(43) **Jeff Farmer\***, University of Northern Colorado, and **A. Arias**, University of Texas at San Antonio (886-46-256)

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Invited Address

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11:00 a.m.–11:50 a.m.

- (44) *Hilbertian operator spaces.*  
**G. Pisier**, Texas A & M University, College Station (886-46-216)

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Invited Address

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1:30 p.m.–2:20 p.m.

- (45) *Symbolic dynamics, probability, and counting problems in geometry.*  
**Steven P. Lalley**, Purdue University, West Lafayette (886-54-166)

---

Special Session on Harmonic Analysis and its Applications, II

---

3:00 p.m.–6:20 p.m.

- 3:00 p.m. *Fourier coefficients and sums of squares.*  
(46) **Kathy D. Merrill\***, Colorado College, and **Lynne H. Walling**, University of Colorado, Boulder (886-43-88)
- 3:30 p.m. *On the density of  $B_k[g]$  sequences and the minimum of dense Cosine sums.*  
(47) **Mihail N. Kolountzakis**, Stanford University (886-11-02)
- 4:00 p.m. *Pointwise convergence of wavelet expansions.*  
(48) **Susan Kelly**, University of Wisconsin, La Crosse, **Mark Andrew Kon\***, Boston University, and **Louise Raphael**, Howard University (886-42-105)
- 4:30 p.m. *Absolute continuity of random  $k$ -adic expansions.*  
(49) **Anca Deliu**, Georgia Institute of Technology (886-39-145)
- 5:00 p.m. *Noise reduction by irregular sampling and local frames.*  
(50) **John J. Benedetto**, University of Maryland, College Park (886-42-06)
- 5:30 p.m. *Affine operators and frames of multivariate wavelets.*  
(51) **Charles K. Chui** and **Xianliang Shi\***, Texas A & M University, College Station (886-42-27)
- 6:00 p.m. *Bounded imaginary powers of elliptic operators.*  
(52) **Gieri Simonett\***, University of California, Los Angeles, **Herbert Amann** and **Matthias Hieber**, University of Zurich, Switzerland (886-47-44)

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Special Session on Several Complex Variables, II

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3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Bergman projection in a smooth non-pseudoconvex domain.*  
(53) **David E. Barrett**, **John Erik Fornaess** and **Zaifei Ye\***, University of Michigan, Ann Arbor (886-32-196)
- 3:30 p.m. *Structure of bad biholomorphic maps.*  
(54) **David E. Barrett**, University of Michigan, Ann Arbor (886-32-203)
- 4:00 p.m. *On the mapping problem for algebraic real hypersurfaces.*  
(55) **Xiaojun Huang**, Washington University (886-32-123)
- 4:30 p.m. *Embeddings of planar domains.*  
(56) **Berit Stenosomes**, University of Michigan, Ann Arbor (886-32-201)
- 5:00 p.m. *Bergman projection of non-pseudoconvex domains.*  
(57) **Peiming Ma**, Purdue University, West Lafayette (886-32-98)
- 5:30 p.m. *Sobolev regularity of the weighted Bergman projections.*  
(58) **Marco M. Peloso**, Polytechnico of Torino, Italy (886-32-103)

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

---

3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Nuclearity of composition operators.*  
(59) **Hans Jarchow\*** and **Reinhard Reidl**, University of Zurich, Switzerland (886-47-153)
- 3:30 p.m. *Composition operators on families of Cauchy transforms. Preliminary report.*  
(60) **R. A. Hirschweiler**, University of New Hampshire (886-30-111)
- 4:00 p.m. *Composition operators on convex domains in  $\mathbb{C}^n$ . Preliminary report.*  
(61) **Peter R. Mercer**, University of North Carolina, Chapel Hill (886-47-124) (Sponsored by James E. McClure)
- 4:30 p.m. *On semigroups of composition operators and their cogenerators.*  
(62) **F. Jafari**, University of Wyoming (886-47-114)
- 5:00 p.m. *Reducing subspaces of composition operators. Preliminary report.*  
(63) **James Guyker**, State University of New York, Buffalo (886-57-76)
- 5:30 p.m. *Spectra of invertible weighted composition operators in spaces of analytic functions.*  
(64) **Arkady Kitover**, Community College of Philadelphia (886-47-214) (Sponsored by Carl C. Cowen)

## Friday, October 22 (cont'd)

### Special Session on Partial Differential Equations, II

3:00 p.m.–4:50 p.m.

- 3:00 p.m. (65) *The Favard class associated with a degenerate nonlinear parabolic problem.* Preliminary report.  
**Gisele Ruiz Goldstein\***, **Jerome A. Goldstein** and **Shinnosuke Oharu**, Louisiana State University, Baton Rouge (886-35-116)
- 3:30 p.m. (66) *Lie generators for semigroups of transformations on a Polish space.*  
**J. R. Dorroh\***, Louisiana State University, Baton Rouge, and **John W. Neuberger**, University of North Texas (886-47-04)
- 4:00 p.m. (67) *Coefficient recovery in a parabolic equation from input sources.*  
**Bruce Lowe\*** and **William Rundell**, Texas A & M University, College Station (886-35-155)
- 4:30 p.m. (68) *Nontrivial solutions for a superlinear Dirichlet problem.*  
**Alfonso Castro\***, University of North Texas, and **Jorge Cossio**, University Nacional de Colombia, Colombia (886-35-228)

### Special Session on Control Systems Governed By Partial Differential Equations, I

3:00 p.m.–5:50 p.m.

- 3:00 p.m. (69) *Nonstandard Riccati equations with applications to boundary control of damped wave and plate equations.*  
**D. Lukes**, **I. Lasiecka\***, University of Virginia, and **L. Pandolfi**, Polytechnico of Torino, Italy (886-49-83)
- 3:30 p.m. (70) *Pseudodifferential methods in regularity analysis for the boundary element method.*  
**Michael Pedersen**, Technical University of Denmark, Copenhagen (886-35-134) (Sponsored by Irena M. Lasiecka)
- 4:00 p.m. (71) *Robustness of multiple-input multiple-output distributed parameter control systems with respect to delays.*  
**Richard Rebarber**, University of Nebraska, Lincoln (886-93-139) (Sponsored by Irena M. Lasiecka)
- 4:30 p.m. (72) *Linear-quadratic boundary control of the potential equation on Lipschitz or polygonal domains.*  
**Zhonghai Ding\*** and **Jianxin Zhou**, Texas A & M University, College Station (886-35-137)
- 5:00 p.m. (73) *Sliding horizon control.*  
**Luther White**, University of Oklahoma (886-93-84)
- 5:30 p.m. (74) *The maximum principle for distributed parameter control systems.*  
**Hector O. Fattorini**, University of California, Los Angeles (886-49-135)

### Special Session on Texas Geometry and Topology, I

3:00 p.m.–5:25 p.m.

- 3:00 p.m. (75) *Algebraic cycles as a topological group functor.*  
**Paulo Lima-Filho**, Texas A & M University, College Station (886-14-209)
- 4:00 p.m. (76) *Spectrum of the number operator on path space.* Preliminary report.  
**Terry Lohrenz**, Rice University (886-58-245) (Sponsored by Tim D. Cochran)
- 4:40 p.m. (77) *An irreducible homology 3-sphere which is not Dehn surgery on a knot.*  
**Dave Auckly**, University of Texas, Austin (886-57-51)

### Special Session on Reaction Diffusion Systems, II

3:00 p.m.–5:50 p.m.

- 3:00 p.m. (78) *Pattern formation in generalized turing systems.*  
**H. G. Othmer**, University of Utah (886-35-150)
- 3:30 p.m. (79)  *$\gamma$ -eigenvalues and the stability of periodic waves.*  
**Robert A. Gardner**, University of Massachusetts, Amherst (886-35-23)
- 4:00 p.m. (80) *Lattice dynamics.*  
**Shui-Nee Chow**, Georgia Institute of Technology (886-34-07)
- 4:30 p.m. (81) *Fast slow systems and singular index pairs.* Preliminary report.  
**Konstantin Mischaikow**, Georgia Institute of Technology (886-34-167)
- 5:00 p.m. (82) *Periodic solutions of reaction-diffusion systems.*  
**Selwyn Hollis\***, Armstrong State College, and **Jeff Morgan**, Texas A & M University, College Station (886-35-125)
- 5:30 p.m. (83) *Dynamics of competition in the unstirred chemostat.*  
**H. L. Smith\***, Arizona State University, **P. Waltman**, Emory University, and **S. B. Hsu**, National Tsing Hua University, Taiwan (886-34-38)

### Special Session on Nonself-adjoint Operator Algebras, II

3:00 p.m.–6:20 p.m.

- 3:00 p.m. (84) *Factorability along commutative subspace lattices.*  
**R. L. Moore** and **T. T. Trent\***, University of Alabama, Tuscaloosa (886-47-93)
- 3:30 p.m. (85) *Locally constant cocycles on AF-algebras.* Preliminary report.  
**Justin R. Peters, III\***, Iowa State College, Ames, and **Allan P. Donsig**, Texas A & M University, College Station (886-46-156)
- 4:00 p.m. (86) *Some results on certain reflexive operator algebras.* Preliminary report.  
**Elias G. Katsoulis**, East Carolina University (886-47-106)

- 4:30 p.m. (87) *Standard Z-analytic TAF algebras and dynamical systems.*  
**Yiu-Tung Poon**, Iowa State College, Ames (886-46-159)
- 5:00 p.m. (88) *The lattice of ideals of a triangular AF algebra.* Preliminary report.  
**Allan P. Donsig\*** and **Timothy D. Hudson**, University of Waterloo (886-46-99)
- 5:30 p.m. (89) *Compressions, graphs, and hyperreflexivity.* Preliminary report.  
**Don Hadwin**, University of New Hampshire (886-47-129) (Sponsored by Eric A. Nordgren)
- 6:00 p.m. (90) *Elementary operators and invariant subalgebras.*  
**Keith J. Coates**, Texas A & M University, College Station (886-46-225)

### Special Session on Representation Theory and Geometry of Non-commutative Algebras, II

#### 3:00 p.m.–4:50 p.m.

- 3:00 p.m. (91) *Minimal prime ideals in the enveloping algebras of Lie superalgebras.* Preliminary report.  
**Ellen E. Kirkman\*** and **James J. Kuzmanovich**, Wake Forest University (886-16-160)
- 3:30 p.m. (92) *The Shapovalev determinant and simple modules.*  
**Gail Letzter**, Massachusetts Institute of Technology (886-17-89)
- 4:00 p.m. (93) *Hopf algebra analogues of Lie algebra results.* Preliminary report.  
**Miriam Cohen**, Ben-Gurion University of the Negev, Israel, **David Fischman\***, University of Southern California, and **Sara Westreich**, Ben Gurion University, Israel (886-16-186)
- 4:30 p.m. (94) *Zero-dimensional symplectic leaves and point modules for quantum  $n \times n$  matrices.*  
**Michaela Vanciliff**, University of Washington (886-14-90)

### Special Session on Identities and Varieties of Algebraic Structures, II

#### 3:00 p.m.–6:20 p.m.

- 3:00 p.m. (95) *In the shadow of the coproduct functor.* Preliminary report.  
**George M. Bergman**, University of California, Berkeley (886-16-11)
- 3:30 p.m. (96) *Multilinear identities in characteristic  $p$ .*  
**Alexander R. Kemer**, Novosibirsk State University, Russia (886-16-141) (Sponsored by John C. Meakin)
- 4:00 p.m. (97) *New central polynomials for the matrix algebras.*  
**Vesselin Drensky**, Bulgarian Academy of Sciences, Bulgaria (886-16-61) (Sponsored by John C. Meakin)
- 4:30 p.m. (98) *\*-Polynomial identities of minimal degree of  $M_n(F)$ ,  $n \geq 4$ .*  
**Alain D'Amour**, Swarthmore College, and **Michel L. Racine\***, University of Ottawa, (886-16-107)
- 5:00 p.m. (99) *On minimal \*-identities of  $n \times n$  matrices.*  
**Antonino Giambruno\*** and **Angela Valenti**, University di Palermo, Italy (886-15-87)

- 5:30 p.m. (100) *A weak polynomial identity and a central polynomial of low degree for  $4 \times 4$  matrices.*  
**Vesselin Drensky**, Bulgarian Academy of Sciences, Bulgaria, and **Giulia Maria Piacentii Cattaneo\***, University of Rome, Italy (886-15-60) (Sponsored by John C. Meakin)
- 6:00 p.m. (101) *Equivalence of  $T_2$ —semiprime ideals of the free algebra.*  
**Onofrio M. Di Vincenzo**, University of Messina, Italy (886-16-86)

### Special Session on Noncommutative Differential Geometry, I

#### 3:00 p.m.–5:50 p.m.

- 3:00 p.m. (102) *Comments concerning noncommutative metrics.* Preliminary report.  
**Marc A. Rieffel**, University of California, Berkeley (886-46-33)
- 3:30 p.m. (103) *Comultiplicative deformation quantizations of the Poisson  $SU(2)$  are not leaf-preserving.* Preliminary report.  
**Albert J.L. Sheu**, University of Kansas (886-46-30)
- 4:00 p.m. (104) *Excision in  $E$ -theory without suspensions.* Preliminary report.  
**Marius Dădărlat**, Purdue University, West Lafayette, and **Terry A. Loring\***, University of New Orleans (886-46-18)
- 4:30 p.m. (105) *On the asymptotic homotopy type of  $C^*$ -algebras.*  
**Marius Dădărlat**, Purdue University, West Lafayette (886-46-08)
- 5:00 p.m. (106) *Some connections between hyperbolic dynamics and Fuchsian groups.* Preliminary report.  
**Jack Spielberg**, Arizona State University (886-46-20)
- 5:30 p.m. (107) *Spectral invariant subalgebras of crossed product  $C^*$  algebras.* Preliminary report.  
**Ronghui Ji\***, Indiana Univ-Purdue University at Indianapolis, and **Larry Schweitzer**, University of Victoria (886-46-168)

### Special Session on The Geometry of Banach Spaces and Operator Spaces, II

#### 3:00 p.m.–6:20 p.m.

- 3:00 p.m. (108) *Some remarks on operator spaces.*  
**Edward G. Effros**, University of California, Los Angeles (886-46-239)
- 3:30 p.m. (109) *Pelczynski's property V in continuous function spaces.*  
**Elizabeth M. Bator\*** and **Paul W. Lewis**, University of North Texas (886-46-45)
- 4:00 p.m. (110) *Informal Discussion*
- 4:30 p.m. (110) *On the cohomology of inclusions of von Neuman algebras.*  
**Florin Pop**, Texas A & M University, College Station (886-46-253)
- 5:00 p.m. (111) *We are interested in different subclasses of the Baire-1 functions on a Polish space  $K$ .*  
**Fouad Chaatit**, University of Texas, El Paso (886-46-248)

## Friday, October 22 (cont'd)

- 5:30 p.m. *Convex block equivalent sequences in Banach spaces.* Preliminary report.  
(112) **Haskell Rosenthal**, University of Texas, Austin (886-46-112)
- 6:00 p.m. *Multi-analytic operators on Fock spaces.*  
(113) **Gelu Popescu**, University of Texas, San Antonio (886-46-237) (Sponsored by Gilles Pisier)

### Special Session on Algebraic Combinatorics, II

#### 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Graphs which are locally Grassmann.* Preliminary report.  
(114) **Richard M. Weiss**, Tufts University (886-20-220)
- 3:30 p.m. *Cycle ideals for distance-regular graphs.*  
(115) **Aaron D. Meyerowitz**, Florida Atlantic University (886-05-221)
- 4:00 p.m. *Strongly regular square-free graphs.* Preliminary report.  
(116) **Benjamin V.C. Collins**, University of Wisconsin, Madison (886-05-130)
- 4:30 p.m. *Spherical designs: Balancing a set of points on the surface of the sphere.* Preliminary report.  
(117) **Bela Bajnok**, Gettysburg College (886-05-35)
- 5:00 p.m. *Askey-Wilson polynomials, kernel polynomials and association schemes.*  
(118) **Laura Chihara**, Saint Olaf College (886-05-219)
- 5:30 p.m. *Antipodal distance-regular graphs of diameter four and five.*  
(119) **Aleksandar Jurisic**, University of Waterloo, (886-05-223)

### General Session

#### 3:00 p.m.–4:45 p.m.

- 3:00 p.m. *Sylow  $p$ -subgroups in the Betti-Mathieu group.*  
(120) Preliminary report.  
**Hong G. Park**, Jeonju University, Korea (886-12-03)
- 3:15 p.m. *Largest factor of an ergodic action with discrete spectrum.* Preliminary report.  
(121) **Edgar N. Reyes**, Southeastern Louisiana University (886-22-22)
- 3:30 p.m. *On a geometric theory of quasilinear reaction diffusion systems.*  
(122) **Gieri Simonett**, University of California Los Angeles (886-35-58) (Sponsored by Jerome A. Goldstein)
- 3:45 p.m. Informal Discussion
- 4:00 p.m. *Isometries and unconditional bases of sequence spaces.*  
(123) **Beata Randrianantoanina**, University of Missouri, Columbia (886-46-50)
- 4:15 p.m.  *$R$ -transforms of free joint distributions, and non-crossing partitions.*  
(124) **Alexandru M. Nica**, University of California, Berkeley (886-46-57)

- 4:30 p.m. *On compactness of composition operators in Hardy spaces of several variables.*  
(125) **Song-Ying Li** and **Bernard Russo\***, University of California, Irvine (886-47-117)

## Saturday, October 23

### Special Session on Harmonic Analysis and its Applications, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Multi-dimensional irreducible cocycles for an irrational rotation.*  
(126) **Lawrence W. Baggett**, University of Colorado, Boulder (886-22-91)
- 8:30 a.m. *A Weyl  $C^*$  algebra for infinite dimensional vector spaces.* Preliminary report.  
(127) **Marc A. Rieffel**, University of California, Berkeley (886-46-32)
- 9:00 a.m. *Transversally elliptic operators on strictly pseudoconvex CR manifolds.*  
(128) **Daryl Geller**, State University of New York, Stony Brook (886-35-53)
- 9:30 a.m. *Radó's theorem for locally solvable vector fields.*  
(129) **Jorge Hounie\*** and **Joaquim Tavares**, Universidade Federal de Pernambuco, Brazil (886-35-15)
- 10:00 a.m. *Asymptotics of oscillatory integrals in  $\mathbb{R}^2$  about degenerate critical points.* Preliminary report.  
(130) **Peter M. Jarvis**, University of Wisconsin, Madison (886-42-200)
- 10:30 a.m. *A van der Corput type lemma and its applications.* Preliminary report.  
(131) **Yi-Biao Pan**, University of Pittsburgh, Pittsburgh (886-11-217)

### Special Session on Several Complex Variables, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Model generic CR submanifolds of  $\mathbb{C}^n$ .* Preliminary report.  
(132) **Alexander Nagel**, University of Wisconsin, Madison (886-32-182)
- 8:30 a.m. *Wavefront sets of CR structures.* Preliminary report.  
(133) **Gábor Francsics**, University of Pennsylvania (886-32-243)
- 9:00 a.m. *Deformations of imbedded quotients of  $S^3$ .*  
(134) **John S. Bland**, University of Toronto, (886-32-195)
- 9:30 a.m. *Analytic discs and CR functions.*  
(135) **Alexander Tumanov**, University of Illinois, Urbana-Champaign (886-32-113)
- 10:00 a.m. *Normal forms for graphs in  $\mathbb{C}^2$ .*  
(136) **Gary A. Harris**, Texas Tech University (886-32-170)
- 10:30 a.m. *Problems on interpolation manifolds.*  
(137) **Yeren Xu**, Temple University, Philadelphia (886-32-185) (Sponsored by Harold P. Boas)

### Special Session on Reaction Diffusion Systems, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Asymptotically autonomous reaction-diffusion systems.*  
(138) **Michael W. Smiley**, Iowa State College, Ames  
(886-35-48)
- 8:30 a.m. *A Stefan-like problem arising from the electrical  
heating of a conductor with conductivity vanishing at  
finite temperature.* Preliminary report.  
(139) **Xiangsheng Xu**, University of Arkansas (886-35-43)  
(Sponsored by William E. Fitzgibbon)
- 9:00 a.m. *Multispike stationary solutions to the Cahn-Hilliard  
equation.*  
(140) **Peter W. Bates\***, Brigham Young University, **Paul Fife**,  
University of Utah, and **Giorgio Fusco**, University of  
Rome, Italy (886-35-149)
- 9:30 a.m. *Positive solutions of reaction diffusion equations.*  
(141) Preliminary report.  
**James R. Ward, Jr.**, University of Alabama,  
Birmingham (886-35-109)
- 10:00 a.m. *Effects of time delays on certain reaction - diffusion  
systems.*  
(142) **William Fitzgibbon**, University of Houston, Downtown,  
**Mary Parrott\***, University of South Florida, and **Glenn  
Webb**, Vanderbilt University (886-35-82)
- 10:30 a.m. *A criss-cross epidemic model with diffusion and  
incubation.*  
(143) **W. E. Fitzgibbon**, University of Houston-University  
Park, **M. E. Parrott**, University of South Florida, and  
**G. F. Webb\***, Vanderbilt University (886-35-171)

### Special Session on Nonself-adjoint Operator Algebras, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Order preservation in limit algebras.*  
(144) **Allan Donsig**, Texas A & M University, College Station,  
and **Alan Hopenwasser\***, University of Alabama,  
Tuscaloosa (886-47-59)
- 8:30 a.m. *Ideals of continuous nest algebras.*  
(145) **John L. Orr**, University of Nebraska, Lincoln  
(886-47-180)
- 9:00 a.m. *Quasidiagonality of direct sums of operators.*  
(146) **Laurent Marcoux\***, University of Alberta, and **Sivaram  
K. Narayan**, Central Michigan University (886-46-241)
- 9:30 a.m. *Operators and wavelets.* Preliminary report.  
(147) **Xingde Dai\***, University of North Carolina, Charlotte,  
and **David R. Larson**, Texas A & M University, College  
Station (886-47-205)
- 10:00 a.m. *Hilbert-Schmidt norm estimates for central  
completions.*  
(148) **M. Bakonyi**, Georgia State University, **V. Kaftal\***,  
**G. Weiss**, University of Cincinnati, and **H. J.  
Woerdeman**, College of William and Mary  
(886-47-207)
- 10:30 a.m. *Operator norm estimates for central completions.*  
(149) **M. Bakonyi**, Georgia State University, **V. Kaftal**,  
**G. Weiss\***, University of Cincinnati, and **H. J.  
Woerdeman**, College of William and Mary  
(886-47-206)

### Special Session on Identities and Varieties of Algebraic Structures, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Lattices of varieties.*  
(150) **Ralph McKenzie**, University of California, Berkeley  
(886-20-174)
- 8:30 a.m. *Lattices of equational theories.* Preliminary report.  
(151) **George McNulty**, University of South Carolina,  
Columbia (886-08-230)
- 9:00 a.m. *Finitely presented groups and completely regular  
semigroups.*  
(152) **K. S. Ajan** and **F. J. Pastijn\***, Marquette University  
(886-20-54)
- 9:30 a.m. *The complexity of the word problem in semigroup  
varieties.*  
(153) **Mark V. Sapir**, University of Nebraska, Lincoln  
(886-20-175) (Sponsored by John C. Meakin)
- 10:00 a.m. *Semigroup varieties with almost commuting fully  
invariant congruences on free objects.*  
(154) **Michael V. Volkov**, Ural State University, Russia  
(886-20-231) (Sponsored by John C. Meakin)
- 10:30 a.m. *Existence varieties of regular semigroups.* Preliminary  
(155) report.  
**Peter R. Jones**, Marquette University (886-20-55)

### Special Session on The Geometry of Banach Spaces and Operator Spaces, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *Banach spaces which admit a norm with the uniform  
Kadec-Klee property.* Preliminary report.  
(156) **Stephen Dilworth**, University of South Carolina,  
Columbia (886-46-249)
- 8:30 a.m. *Isometric stability property of certain Banach spaces.*  
(157) **Alexander Koldobsky**, University of Texas at San  
Antonio (886-46-13)
- 9:00 a.m. *The Haagerup invariant of von Neumann algebras.*  
(158) **Roger Smith\***, Texas A & M University, College  
Station, and **Allan Sinclair**, University of Edinburgh,  
United Kingdom (886-46-255)
- 9:30 a.m. *On property (w) in spaces of vector-valued functions.*  
(159) **Paulette Saab**, University of Missouri, Columbia  
(886-46-46)
- 10:00 a.m. *Constructions of  $L_p$  revisited.*  
(160) **Dale E. Alspach**, Oklahoma State University,  
Stillwater (886-46-246)
- 10:30 a.m. *Tensor products of operator spaces.*  
(161) **David Blecher**, University of Houston, University Park  
(886-46-238) (Sponsored by Gilles Pisier)

### Special Session on Algebraic Combinatorics, III

#### 8:00 a.m.–10:50 a.m.

- 8:00 a.m. *The P- and Q-polynomial schemes of thin type.*  
(162) **Paul Terwilliger**, University of Wisconsin, Madison  
(886-05-215)



## Saturday, October 23 (cont'd)

- 8:30 a.m. *On a Clebsch Gordon problem.*  
(163) **Fan R.K. Chung\***, Bellcore, 445 South Street, Morristown, New Jersey, and **Shlomo Sternberg**, Harvard University (886-05-198)
- 9:00 a.m. *Sharp characters of quasigroups and association schemes.* Preliminary report.  
(164) **Kenneth W. Johnson**, Pennsylvania State University, Ogontz (886-05-144)
- 9:30 a.m. *Kite-free  $P$ - and  $Q$ -polynomial association schemes.*  
(165) **Chih-Wen Weng**, University of Wisconsin, Madison (886-05-192)
- 10:00 a.m. *Quotients of association schemes.*  
(166) **Chris D. Godsill**, University of Waterloo, and **William J. Martin\***, University of Winnipeg (886-05-77)
- 10:30 a.m. *Association schemes, superschemes, and permutation actions.* Preliminary report.  
(167) **Jonathan D.H. Smith**, Iowa State University (886-05-142) (Sponsored by Sung Y. Song)

### Special Session on Composition Operators on Spaces of Analytic Functions, III

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *The Berezin symbol with composition operators.*  
(168) Preliminary report.  
**Semra Kilic**, University of New Hampshire (886-47-244)
- 9:00 a.m. *Composition preserves rigidity.*  
(169) **B. A. Lotto\***, Vassar College, and **J. E. McCarthy**, Washington University (886-47-162)
- 9:30 a.m. *Composition operators belonging to the Schatten classes and the geometry of their Eigenfunctions.* Preliminary report.  
(170) **Richard Rochberg** and **Hong Xian\***, Washington University, St. Louis (886-47-16)
- 10:00 a.m. *Composition operators between different Bergman spaces.*  
(171) **Marian E. Robbins**, Bellarmine College (886-47-161)
- 10:30 a.m. *Homomorphisms of Banach algebras with range in  $C^1[0, 1]$ .*  
(172) **Herbert Kamowitz\***, University of Massachusetts, Boston, and **Stephen Scheinberg**, University of California, Irvine (886-46-128)

### Special Session on Noncommutative Differential Geometry, II

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. Informal Discussion
- 9:00 a.m. *Cyclic cohomology of smooth discrete groupoids.*  
(173) **Victor Nistor**, Pennsylvania State University, University Park (886-46-234)

- 9:30 a.m. *Exotic index and almost flat spectrum.* Preliminary report.  
(174) **Steven Hurder**, University of Illinois, Chicago (886-58-233)
- 10:00 a.m. *Continuous fields of cyclic cocycles and an index formula for elliptic operators.* Preliminary report.  
(175) **George A. Elliott**, University of Copenhagen, Denmark, and **Toshikazu Natsume\***, State University of New York, Buffalo (886-19-12)
- 10:30 a.m. *Zero spectrum problem for certain noncompact Riemannian manifolds.*  
(176) **Guoliang Yu**, University of Colorado, Boulder (886-46-19)

### Special Session on Partial Differential Equations, III

#### 9:00 a.m.–10:50 a.m.

- 9:00 a.m. *The super-Stefan problem and hysteresis.*  
(177) **T. D. Little** and **R. E. Showalter\***, University of Texas at Austin (886-35-56)
- 9:30 a.m. *On multiple stationary black hole solutions of the Einstein-Maxwell equations.*  
(178) **Gilbert Weinstein**, University of Alabama at Birmingham (886-83-25)
- 10:00 a.m. *On solutions of certain nonlinear parabolic problems arising from low temperature heat conduction in metals.*  
(179) **Dongming Wei**, University of New Orleans (886-35-36)
- 10:30 a.m. *Reflectionless boundary propagation formulas for the wave equation.*  
(180) **Henry Warchall**, University of North Texas (886-35-229)

### Special Session on Texas Geometry and Topology, II

#### 9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Moduli of singular Yang-Mills fields.*  
(181) **Lorenzo Sadun**, University of Texas, Austin (886-58-208)
- 9:40 a.m. *Complete constant mean curvature surfaces in hyperbolic space.*  
(182) **Yoshihiro Tonegawa**, Courant Institute of Mathematical Sciences, New York University (886-53-163)
- 10:20 a.m. *Existence of hypersurfaces of prescribed mean curvature.* Preliminary report.  
(183) **T. David Hendricks**, Texas A & M University, College Station (886-53-226)

# Special Session on Representation Theory and Geometry of Non-commutative Algebras, III

## 9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Indecomposable coalgebras and pointed Hopf algebras.*  
(184) **Susan Montgomery**, University of California, Los Angeles (886-16-80)
- 9:30 a.m. *Quantum Weyl algebras.*  
(185) **Anthony Giaquinto\*** and **James J. Zhang**, University of Michigan, Ann Arbor (886-16-66)
- 10:00 a.m. *Regular graded algebras of global dimension three.*  
(186) Preliminary report.  
**Darin R. Stephenson**, University of Michigan, Ann Arbor (886-16-69)
- 10:30 a.m. *Some 3-dimensional skew polynomial rings.*  
(187) Preliminary report.  
**Allen D. Bell\***, University of Wisconsin, Milwaukee, and **S. Paul Smith**, University of Washington (886-16-104)

## Invited Address

## 11:00 a.m.–11:50 a.m.

- (188) *Title to be announced.*  
**Theodore A. Slaman**, University of Chicago (886-99-259)

## Invited Address

## 1:30 p.m.–2:20 p.m.

- (189) *Nonconnected moduli spaces of positive sectional curvature metrics.*  
**Matthias Kreck**, University of Mainz, Germany, and **Stephan Stolz\***, University of Notre Dame (886-53-258)

# Special Session on Harmonic Analysis and its Applications, IV

## 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *A class of bilinear forms on the Dirichlet type spaces.*  
(190) **Zhijian Wu**, University of Alabama, Tuscaloosa (886-47-154)
- 3:30 p.m.  *$H^P$ -Corona theorems.* Preliminary report.  
(191) **Kai-Ching Lin**, University of Alabama, Tuscaloosa (886-30-39) (Sponsored by Tavan T. Trent)
- 4:00 p.m. *Atomic decomposition for Hardy spaces on domains in  $\mathbb{C}^n$ .*  
(192) **Galia Dafni**, Princeton University (886-42-127)
- 4:30 p.m. *A Fatou theorem for the heat equation by way of a Carleson condition.*  
(193) **Caroline Sweezy**, New Mexico State University, Las Cruces (886-35-41)

- 5:00 p.m. *Unique continuation with weak type lower order terms.*  
(194) **Thomas Wolff**, University of California, Berkeley, and **Guozhen Lu\***, Wright State University, Dayton (886-35-131) (Sponsored by Michael Aschbacher)
- 5:30 p.m. *Multilinear singular integrals, rough operators, and caloric layer potentials.*  
(195) **Steve Hofmann**, Wright State University, Dayton (886-42-146)

# Special Session on Several Complex Variables, IV

## 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Polynomial hulls, Jensen measures, and clusters of analytic disks.*  
(196) **Evgeny A. Poletsky**, Syracuse University (886-32-70) (Sponsored by Harold P. Boas)
- 3:30 p.m. *On the existence of exceptional analytic disks.*  
(197) **Kang-Tae Kim**, Brown University (886-32-121)
- 4:00 p.m. *Minimal interpolation in the ball of  $C^n$ .* Preliminary report.  
(198) **J. A. Cima**, University of North Carolina, Chapel Hill, and **Michael Stessin\***, State University of New York, Albany (886-32-17)
- 4:30 p.m. *A removable singularities theorem for families of two-dimensional fiber-bundles and rational surfaces.* Preliminary report.  
(199) **Adam Harris**, State University of New York, Stony Brook (886-32-189)
- 5:00 p.m. *Global analyticity for  $\square_b$  on three dimensional CR manifolds.*  
(200) **David S. Tartakoff\***, University of Illinois at Chicago, and **Makhlouf Derridj**, University of Paris-Sud, France (886-32-09)
- 5:30 p.m. *Analytic regularity of the  $\bar{\partial}_b$ -Neumann problem on rigid tubes.*  
(201) **Ricardo L. Diaz**, University of Northern Colorado (886-35-235)

# Special Session on Composition Operators on Spaces of Analytic Functions, IV

## 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Composition operators and the determining function.*  
(202) **Nina Zorboska**, University of Manitoba, (886-47-213)
- 3:30 p.m. *Degrees of normality for composition operators.*  
(203) **Douglas C. Szajda**, Saint Olaf College (886-30-212)
- 4:00 p.m. *Local spectral theory for some linear fractional composition operators.* Preliminary report.  
(204) **R. C. Smith**, Mississippi State University (886-47-120)
- 4:30 p.m. *Compact composition operators on Bloch-type spaces.*  
(205) **Kevin M. Madigan**, State University of New York, Albany (886-47-52)
- 5:00 p.m. *Weighted composition operators and evolutionary semigroups.*  
(206) **Yuri Latushkin\*** and **S. Montgomery-Smith**, University of Missouri, Columbia (886-47-62)

## Saturday, October 23 (cont'd)

### Special Session on Partial Differential Equations, IV

#### 3:00 p.m.–4:50 p.m.

- 3:00 p.m. *Obstacle scattering for elastic waves*. Preliminary report.  
(207) **Jerome A. Goldstein\*** and **Genbao Shi**, Louisiana State University, Baton Rouge (886-35-119)
- 3:30 p.m. *On ground states of semilinear elliptic equations with supercritical and subcritical Sobolev growth*.  
(208) **Henghui Zou**, Northwestern University (886-35-81)
- 4:00 p.m. *A radial basis function approach to solving PDEs numerically*.  
(209) **Francis J. Narcowich**, Texas A & M University, College Station (886-35-197)
- 4:30 p.m. *Nonradial solutions of a semilinear elliptic problem*.  
(210) **Henry Warchall** and **Joseph Iaia\***, University of North Texas (886-35-227)

### Special Session on Control Systems Governed By Partial Differential Equations, II

#### 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Modelling and controllability of a plate-beam system*.  
(211) **John E. Lagnese**, Georgetown University (886-35-133)
- 3:30 p.m. *Approximation methods for robust control design for damped elastic systems*.  
(212) **Richard H. Fabiano, Jr.**, Texas A & M University, College Station (886-49-138) (Sponsored by John E. Lagnese)
- 4:00 p.m. *Some controlled and uncontrolled wave and heat phenomena, a video show*.  
(213) **Goong Chen\***, **Jianxin Zhou** and **Chih-Hsun Chen**, Texas A & M University, College Station (886-35-136)
- 4:30 p.m. *Modeling of proof-mass actuator*.  
(214) **Hankun Wang**, Wichita State University (886-35-132) (Sponsored by Goong Chen)
- 5:00 p.m. *Optimal control of Ginzberg-Landau equation*.  
(215) **Yuncheng You**, University of South Florida (886-49-26)
- 5:30 p.m. *A smoothing property of the KdV equation and its applications to control*. Preliminary report.  
(216) **Bingyu Zhang**, University of Cincinnati (886-35-140) (Sponsored by Yuncheng You)

### Special Session on Texas Geometry and Topology, III

#### 3:00 p.m.–5:05 p.m.

- 3:00 p.m. *A matrix for computing the Jones polynomial of a knot*.  
(217) **Louis P. Zulli**, Rice University (886-57-75)

- 3:40 p.m. *Defects of Schottky groups*. Preliminary report.  
(218) **James W. Anderson**, Rice University (886-30-187)
- 4:20 p.m. *Dipole solutions to the Meron problem*.  
(219) **Karen Uhlenbeck**, University of Texas, Austin (886-58-232)

### Special Session on Reaction Diffusion Systems, IV

#### 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Reactive flows in porous media: Rigorous results*.  
(220) **John Chadam**, McMaster University (886-35-172)
- 3:30 p.m. *Practical persistence in ecological models via comparison methods*.  
(221) **R. S. Cantrell** and **C. Cosner\***, University of Miami (886-35-72)
- 4:00 p.m. *Permanence in reaction diffusion systems*. Preliminary report.  
(222) **Klaus Schmitt**, University of Utah (886-35-152)
- 4:30 p.m. Informal Discussion

### Special Session on Nonself-adjoint Operator Algebras, IV

#### 3:00 p.m.–6:20 p.m.

- 3:00 p.m. *Simultaneous triangulizability and near commutativity*.  
(223) **A. R. Sourour**, University of Victoria (886-47-224)
- 3:30 p.m. *Cocycles on AF groupoids and their triangular algebras*. Preliminary report.  
(224) **Belisario A. Ventura**, California State University, San Bernardino (886-46-40)
- 4:00 p.m. *Locally constant non-product type cocycles*.  
(225) **Belisario A. Ventura**, California State University San Bernardino, and **Bruce H. Wagner\***, Iowa State College, Ames (886-46-183) (Sponsored by Yiu-Tung Poon)
- 4:30 p.m. *Algebra isomorphisms of triangular operator algebras*.  
(226) **Chaoxin Qiu**, Iowa City, Iowa (886-47-95)
- 5:00 p.m. *On certain Banach limits of triangular matrix algebras*.  
(227) **Richard L. Baker**, University of Iowa (886-46-65) (Sponsored by Philip C. Kutzko)
- 5:30 p.m. *Factorization of positive operators in nest algebras*.  
(228) **K. Davidson** and **H. Huang\***, University of Waterloo (886-47-204)
- 6:00 p.m. *Local automorphisms on operator algebras*.  
(229) **Randall L. Crist**, Creighton University (886-46-100)

### Special Session on Representation Theory and Geometry of Non-commutative Algebras, IV

#### 3:00 p.m.–4:50 p.m.

- 3:00 p.m. *Sklyanin algebras*.  
(230) **John Tate**, University of Texas, Austin (886-16-110)
- 3:30 p.m. *Linear spaces in noncommutative projective geometry*.  
(231) **Joanna M. Staniszis**, Texas A & M University, College Station (886-16-158)

- 4:00 p.m. *Noncommutative projective geometry.*  
(232) **Michael Artin**, Massachusetts Institute of Technology, and **James J. Zhang\***, University of Michigan, Ann Arbor (886-16-165)
- 4:30 p.m. *Graded rings of Gelfand-Kirillov dimension two and projective curves.* Preliminary report.  
(233) **M. Artin**, Massachusetts Institute of Technology, and **J. T. Stafford\***, University of Michigan, Ann Arbor (886-16-118)

### Special Session on Identities and Varieties of Algebraic Structures, IV

#### 3:00 p.m.–6:20 p.m.

- 3:00 p.m. *On additional laws in the Burnside problem on periodic groups.* Preliminary report.  
(234) **Efim Zelmanov**, University of Wisconsin, Madison (886-20-173) (Sponsored by John C. Meakin)
- 3:30 p.m. *The word problem for the variety  $B_n$ .*  
(235) **Olga G. Kharlampovich**, McGill University (886-20-176) (Sponsored by John C. Meakin)
- 4:00 p.m. *Minimal varieties of lattice-ordered groups.*  
(236) **W. Charles Holland\***, Bowling Green State University, and **Nikolai Ya Medvedev**, Altai State University, Russia (886-06-01)
- 4:30 p.m. *Some non-finitely based varieties of group representations.* Preliminary report.  
(237) **C. K. Gupta\***, University of Manitoba, and **A. N. Krasilnikov**, Moscow State Pedagogical Institute, Russia (886-20-178) (Sponsored by Narain D. Gupta)
- 5:00 p.m. *Growth of varieties of group representations and the Gelfand-Kirillov dimension.* Preliminary report.  
(238) **Samuel M. Vovsi**, Trenton State College (886-20-177)
- 5:30 p.m. *On the additive groups of free objects in varieties of integral group representations.*  
(239) **A. N. Krasilnikov**, Moscow State Pedagogical Institute, Russia (886-20-179) (Sponsored by Samuel M. Vovsi)
- 6:00 p.m. Informal Discussion

### Special Session on Noncommutative Differential Geometry, III

#### 3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Cosheaf homology and cyclic homology.*  
(240) **Paul F. Baum**, Pennsylvania State University, University Park (886-18-63)
- 3:30 p.m. Informal Discussion
- 4:00 p.m. *Fredholm operators on open manifolds.* Preliminary report.  
(241) **Peter Haskell**, Virginia Polytech Institute & State University (886-58-14)
- 4:30 p.m. *Classification of certain  $C^*$  algebras of real rank 0.*  
(242) **Guihua Gong**, University of Puerto Rico (886-46-21) (Sponsored by Efton L. Park)
- 5:00 p.m. *Transversally elliptic operators for compact group actions.*  
(243) **Jeffrey Fox\***, University of Colorado, Boulder, and **Peter Haskell**, Virginia Polytech Institute & State University (886-58-31)

### Special Session on The Geometry of Banach Spaces and Operator Spaces, IV

#### 3:00 p.m.–6:20 p.m.

- 3:00 p.m. *Asymptotic infinite dimensional theory.*  
(244) **Vitali Milman\***, Tel Aviv University, Israel, **B. Maurey**, University of Paris VII, France, and **N. Tomczak-Jaegerman**, University of Alberta (886-46-252)
- 3:30 p.m. *The operator amenability of  $A(G)$  for compact groups  $G$ .*  
(245) **Zhong-Jin Ruan**, University of Illinois, Urbana-Champaign (886-47-254)
- 4:00 p.m. *The maximal operator space structure on a normed space.*  
(246) **Vern Paulsen**, University of Houston, University Park (886-46-240)
- 4:30 p.m. *Stability of some types of Radon-Nikodym properties.*  
(247) **Narcisse Randrianantoanina** and **Elias Saab\***, University of Missouri, Columbia (886-46-47)
- 5:00 p.m. *On some properties of  $\ell_p$ -tensor products.*  
(248) **Alvaro Arias**, University of Texas, San Antonio (886-46-247)
- 5:30 p.m. Problem Session
- 6:00 p.m. *On Banach spaces with the 2-summing property.*  
(249) **T. Figiel**, Polish Academy of Science, Poland, **W. B. Johnson\***, Texas A & M University, College Station, and **G. Schechtman**, Weizmann Institute of Science, Israel (886-46-257)

### Special Session on Algebraic Combinatorics, IV

#### 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Antipodal distance transitive covers of complete bipartite graphs.*  
(250) **A. A. Ivanov**, Institute for System Studies, Russia, **Robert A. Liebler\***, Colorado State University, **Tim Penttila** and **Cheryl E. Praeger**, University of Western Australia, Australia (886-05-148)
- 3:30 p.m. *Krein conditions for coherent configurations.*  
(251) **Sylvia A. Hobart**, University of Wyoming (886-05-193)
- 4:00 p.m. *Quadratic forms in the construction of designs and near large sets of designs.*  
(252) **Dwijendra Ray-Chaudhuri**, Ohio State University, Columbus (886-05-199)
- 4:30 p.m. *Twice  $Q$ -polynomial distance-regular graphs.*  
(253) **Garth A. Dickie**, University of Wisconsin, Madison (886-05-222)
- 5:00 p.m. *Symmetric pseudocyclic association schemes.* Preliminary report.  
(254) **Sung Yell Song**, Iowa State College, Ames (886-05-143)
- 5:30 p.m. *On a generalization of the  $q$ -Johnson association scheme.*  
(255) **Gregory Hill**, University of North Texas (886-05-218)

**Andy R. Magid**  
Associate Secretary  
Norman, Oklahoma

# The Claremont Colleges, Claremont, California

## November 6–7, 1993

### *Preliminary Program*

The eight hundred and eighty-seventh meeting of the American Mathematical Society (AMS) will be held on the Harvey Mudd College campus of The Claremont Colleges in Claremont, California, on Saturday and Sunday, November 6 and 7, 1993. This meeting will take place concurrently with a meeting of the Southern California section of the Mathematical Association of America (MAA).

#### *Invited Addresses*

By invitation of the Western Section Program Committee there will be four invited one-hour addresses. The speakers, their affiliations, the titles of their talks, and scheduled times of presentation are as follows:

**Krzysztof Burdzy**, University of Washington, *Brownian motion and potential theory*, 11:00 a.m., Saturday;

**Nassif Ghoussoub**, University of British Columbia, *Morse theory up to  $\epsilon$* , 11:00 a.m., Sunday;

**N. Makarov**, California Institute of Technology, *Fine structure of harmonic measure*, 2:00 p.m., Saturday;

**Nicholai Reshetikhin**, University of California, Berkeley, *On quantum groups*, 2:00 p.m., Sunday.

#### *Special Sessions*

By invitation of the same committee there will be seven special sessions of selected twenty-minute papers. The topics of these sessions and the names and affiliations of the organizers are as follows:

*Mathematical models in epidemiology*, **Fred Brauer**, University of Wisconsin, Madison, and **Carlos Castillo-Chavez**, Cornell University;

*Dynamical systems and chaos*, **Mario U. Martelli**, California State University;

*Industrial applied mathematics*, **Ellis Cumberbatch**, Claremont Graduate School;

*Computational number theory*, **David G. Cantor**, University of California, Los Angeles;

*Brownian motion and applications to potential theory*, **Steven N. Evans**, University of California, Berkeley;

*Nonlinear analysis and Banach space theory*, **Nassif Ghoussoub** and **Edward Odell**, University of Texas at Austin;

*Quantum groups and quantum topology*, **Nicholai Reshetikhin**.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

#### *Contributed Papers*

There will also be sessions for contributed ten-minute papers. The deadline for submission of abstracts for these sessions has expired. Unfortunately, late papers cannot be accommodated.

#### *Registration*

The meeting registration desk will be located in the lobby of Galileo Hall, Harvey Mudd College. The desk will be open from 8:30 a.m. to 2:00 p.m. on both Saturday and Sunday, November 6 and 7. The registration fees are \$30 for members of the AMS; \$45 for nonmembers; and \$10 for emeritus members, students, and unemployed mathematicians.

#### *Activities of Other Organizations*

The Southern California Section of the MAA will meet on Saturday, November 6. MAA invited addresses include: **Morris W. Hirsch**, University of California, Berkeley, *Mathematical myths*, 10:00 a.m.; **Herbert A. Dekleine**, California State Polytechnic University, San Luis Obispo, *Recent court rulings on apportioning fractions*, 2:00 p.m.; and **Robert Borrelli** and **Courtney Coleman**, Harvey Mudd College, *Visualizing solutions of differential equations*, 3:00 p.m.

There will be a luncheon at noon in the Claremont Colleges Faculty House. The cost for the luncheon is \$12 per person. **Melvin Henriksen**, Harvey Mudd College, will give the luncheon address: *When algebra met topology: Rings of continuous functions in the 50s*. **Luncheon tickets are to be purchased in advance from Barbara Beechler, Pitzer College, Claremont, CA 91711. Since seating is limited, luncheon reservations must be made by October 30, 1993.**

There is a \$15 special one-day fee for MAA members attending the MAA meeting on Saturday. The special fees for other categories for those attending the MAA meeting on Saturday only are students and unemployed mathematicians \$5 and non-MAA members \$20.

#### *Accommodations*

Rooms have been blocked at the following hotels and motels. Participants should make their own reservations directly with the hotel of their choice, identifying themselves as attending the AMS meeting at The Claremont Colleges. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

Shuttle service from and to Ontario International Airport is provided free of charge.

### Griswold's Inn

555 West Foothill Boulevard, Claremont, CA 91711  
 Telephone: 800-854-5733 (except in California), 800-821-0341 (in California), or 909-626-2411  
 Rooms (1-4 persons) \$60.00 plus tax  
**Rooms must be reserved before October 23, 1993.**  
**Griswold's is within walking distance of the campus and provides a complimentary full buffet breakfast.**

### Ramada Inn

840 South Indian Hill Boulevard, Claremont, CA 91711  
 Telephone: 800-322-6559 or 909-621-4831  
 Rooms (single or double) \$48 plus tax  
**Rooms must be reserved before October 23, 1993.**  
**The Ramada Inn is next to the San Bernardino Freeway (Interstate 10), 2.5 miles from the campus. The Ramada will furnish complimentary shuttle service to the campus and complimentary continental breakfast.**

### Parking

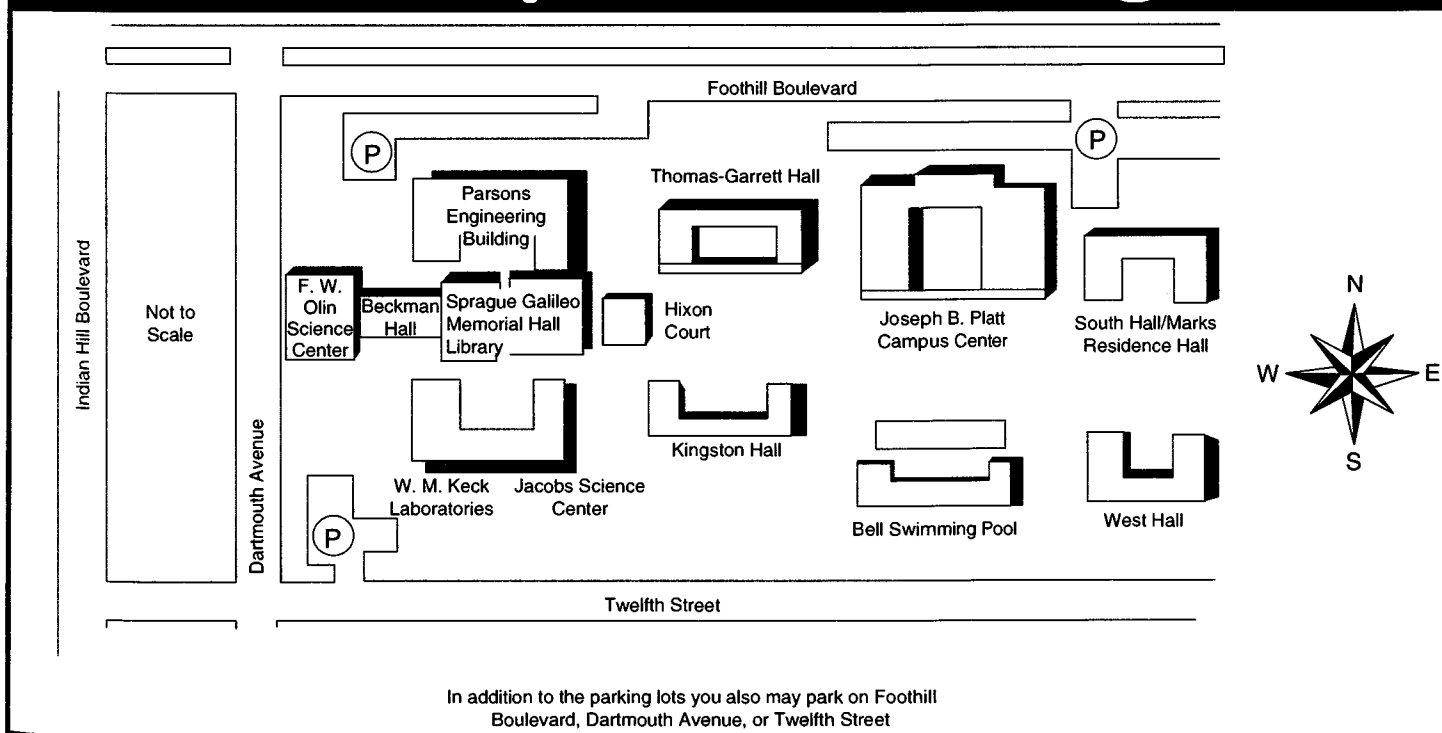
Parking is available in the lots on the north and south sides of the Olin Science Center and on the streets surrounding the campus. There is no charge for parking.

### Travel and Local Information

Most major airlines serve Ontario International Airport (California). Continental has been declared the official airline for this meeting. Special airfares include a 40% discount off the full "Y" or "F" class fares or a 5% discount off restricted round trip fares. Please call Continental at 1-800-468-7022 Monday through Friday, 6:00 a.m. to 11:59 p.m., Saturday and Sunday, 8:00 a.m. to 9:00 p.m., for reservations and details on applicable restrictions, if any. Refer to Easy Access Number ZMW17. Once reservations have been made, tickets may be purchased from any licensed travel agent Continental ticket office, or airport ticket counter.

Driving time from Ontario Airport to campus is 15 to 20 minutes. The drive from Los Angeles International Airport (LAX) is slow, particularly on Friday afternoons (allow at least one hour). To get to the Galileo complex on the Harvey Mudd campus where the meetings will be held you should turn north on Indian Hill Boulevard (Exit 47 on Interstate 10) and then go east for four blocks on Foothill Boulevard to Dartmouth Avenue.

# Harvey Mudd College





# Presenters of Papers

Numbers following the names indicate the speakers' positions on the program.  
 • AMS Invited Lecturer                      \* AMS Special Session Speaker

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## LECTURES ON MATHEMATICS IN THE LIFE SCIENCES

### Some Mathematical Questions in Biology: Predicting Spatial Effects in Ecological Systems

Robert H. Gardner, Editor  
 Volume 23

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1991 *Mathematics Subject Classification*: 92; 93, 90

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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 1993 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.

## Saturday, November 6

### Special Session on Mathematical Models in Epidemiology, I

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *The theory and practice of epidemiology: My interaction with Stavros Busenberg.*  
(1) **Carlos Castillo-Chavez**, Cornell University (887-92-64)
- 9:00 a.m. *A model of HIV transmission in Asia.* Preliminary report.  
(2) **S. N. Busenberg**, Harvey Mudd College, **K. L. Cooke\***, Pomona College, and **Y-H. Hsieh**, National Chung-Hsing University, Taiwan (887-92-10)
- 9:30 a.m. *A model for HIV/AIDS with infectious stages.*  
(3) **Xiaodong Lin**, University of Waterloo, **Herbert W. Hethcote**, University of Iowa, and **P. Van Den Driessche\***, University of Victoria (887-92-06)
- 10:00 a.m. *Approximating the ages of partners in models of the spread of HIV.*  
(4) **E. Ann Stanley**, Iowa State University (887-92-17)
- 10:30 a.m. *Recruitment and treatment in sexually transmitted diseases.*  
(5) **Jorge X. Velasco-Hernandez**, University Autonoma Metropolitana-Iztapalapa, Mexico (887-92-77)

### Special Session on Industrial Applied Mathematics, I

#### 8:30 a.m.–10:20 a.m.

- 8:30 a.m. *A semiempirical approach to describing I-V characteristics in MOSFET devices.*  
(6) **Alisa Crowe**, Claremont Graduate School (887-78-73)
- 9:00 a.m. *A direct approach to solving the drift-diffusion model equations for MOSFET devices.*  
(7) **Jerome Spanier**, Claremont Graduate School (887-78-72) (Sponsored by Robert E. Williamson)
- 9:30 a.m. *Fog capture.*  
(8) **Ellis Cumberbatch**, Claremont Graduate School (887-76-71) (Sponsored by Robert E. Williamson)

- 10:00 a.m. *Unsteady hypersonic thin shock layers and flow stability.*  
(9) **N. D. Malmuth**, Rockwell International Corporation, Thousand Oaks, California (887-76-70) (Sponsored by Robert E. Williamson)

### Special Session on Nonlinear Analysis and Banach Space Theory, I

#### 8:30 a.m.–10:50 a.m.

- 8:30 a.m. *Averages of segments of a bush.* Preliminary report.  
(10) **Robert C. James**, Claremont Graduate School (887-46-13)
- 9:00 a.m. *A renorming of  $\ell_1$  and the optimality of the James distortion theorem.* Preliminary report.  
(11) **P. N. Dowling**, Miami University, Oxford, **W. B. Johnson\***, Texas A & M University, College Station, **C. J. Lennard**, University of Pittsburgh, Pittsburgh, and **J. B. Turett**, Oakland University (887-46-66)
- 9:30 a.m. *Banach spaces for which all subspaces have LUST, Part II.* Preliminary report.  
(12) **Peter Casazza\***, University of Missouri, Columbia, **Bernard Maurey**, University of Paris VII, France, and **Nicole Tomczak-Jaegermann**, University of Alberta (887-46-37)
- 10:00 a.m. *On distorted norms on Schatten classes of operators.* Preliminary report.  
(13) **Nicole Tomczak-Jaegermann**, University of Alberta (887-46-38)
- 10:30 a.m. *Some remarks on twisted Hilbert spaces.*  
(14) **Nigel Kalton**, University of Missouri, Columbia (887-46-51)

### Special Session on Computational Number Theory, I

#### 9:00 a.m.–10:50 a.m.

- 9:00 a.m. *On Coppersmith's block version of Wiedemann's algorithm for solving sparse systems of linear equations.* Preliminary report.  
(15) **J. P. Buhler**, Reed College (887-11-18)
- 10:00 a.m. Discussion
- 10:30 a.m. *Number field sieve with several large primes.* Preliminary report.  
(16) **Peter L. Montgomery**, Oregon State University (887-11-49)

## Saturday, November 6 (cont'd)

### Special Session on Brownian Motion and Applications to Potential Theory, I

#### 9:45 a.m.–10:30 a.m.

- 9:45 a.m. *A stochastic Hopf bifurcation.*  
(17) **Peter H. Baxendale**, University of Southern California (887-60-07)

#### Invited Address

#### 11:00 a.m.–11:50 a.m.

- (18) *Brownian motion and potential theory.*  
**Krzysztof Burdzy**, University of Washington (887-60-60)

#### Invited Address

#### 2:00 p.m.–2:50 p.m.

- (19) *Fine structure of harmonic measure.*  
**N. G. Makarov**, Russian Academy of Science, Russia and California Institute of Technology (887-99-75)

### Special Session on Dynamical Systems and Chaos, I

#### 3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Large-time behavior of solutions of asymptotically autonomous differential equations.*  
(20) **Horst R. Thieme**, Arizona State University (887-34-31)
- 3:30 p.m. *Some new results concerning the global dynamics of near-integrable Hamiltonian systems.*  
(21) **Stephen Wiggins**, California Institute of Technology (887-58-33) (Sponsored by Mario U. Martelli)
- 4:00 p.m. *Approximating the invariant measures of finite dimensional maps.*  
(22) **Fern Hunt**, National Institute of Standards & Technology, Gaithersburg, Maryland (887-34-34)
- 4:30 p.m. *Bounds for the Lipschitz constant of finite dimensional differential equations with periodic solutions.*  
(23) Preliminary report.  
**David C. Fisher**, University of Colorado, Denver (887-34-25) (Sponsored by Mario U. Martelli)
- 5:00 p.m. *Exploiting symmetry in numerical analysis.*  
(24) **K. Georg\*** and **J. Tausch**, Colorado State University (887-65-26)

### Special Session on Computational Number Theory, II

#### 3:00 p.m.–5:50 p.m.

- 3:00 p.m. *Polynomials for the number field sieve.* Preliminary report.  
(25) **Robert O. Robson**, Oregon State University (887-11-74)
- 3:30 p.m. *Equidistant arithmetic codes and character sums.*  
(26) **Daniel M. Gordon**, Center for Communications Research, San Diego, California (887-94-57)
- 4:00 p.m. *A subexponential algorithm for discrete logarithms over all finite fields.*  
(27) **Leonard M. Adleman** and **Jonathan DeMarrais\***, University of Southern California (887-11-11) (Sponsored by David G. Cantor)
- 4:30 p.m. *Small non-residues in finite fields.* Preliminary report.  
(28) **Ming-Deh Huang**, University of Southern California (887-14-59) (Sponsored by David G. Cantor)
- 5:00 p.m. Discussion
- 5:30 p.m. *Counting rational points on curves over finite fields.*  
(29) Preliminary report.  
**Douglas J. Ierardi\*** and **Ming-Deh Huang**, University of Southern California (887-11-36)

### Special Session on Brownian Motion and Applications to Potential Theory, II

#### 3:00 p.m.–5:35 p.m.

- 3:00 p.m. *Existence and uniqueness of semimartingale reflecting Brownian motions in convex polyhedrons.*  
(30) **J. G. Dai**, Georgia Institute of Technology, and **Ruth J. Williams\***, University of California at San Diego, La Jolla (887-60-22)
- 3:55 p.m. Informal Discussion

### Special Session on Nonlinear Analysis and Banach Space Theory, II

#### 3:00 p.m.–5:20 p.m.

- 3:00 p.m. *Descriptive set theory applied to Banach spaces.*  
(31) **Gilles Godefroy**, Universit  Paris VI, France and University of Missouri-Columbia (887-46-35) (Sponsored by Edward Odell)
- 3:30 p.m. *Boundedly complete skipped blocking decompositions.*  
(32) **Steven F. Bellenot**, Florida State University (887-46-16)
- 4:00 p.m.  *$\epsilon$ -subgradients versus subgradients.*  
(33) **Maria Elena Verona**, Pasadena City College, Pasadena (887-47-47) (Sponsored by Andrei Verona)
- 4:30 p.m. *Spreading models and smooth surjective mappings of Banach spaces.*  
(34) **Sean M. Bates**, University of California, Berkeley (887-58-46) (Sponsored by Edward Odell)
- 5:00 p.m. *A finitely block universal Banach space.* Preliminary report.  
(35) **E. Odell\***, University of Texas, Austin, and **Th. Schlumprecht**, Texas A & M University, College Station (887-46-55)

### Special Session on Quantum Groups and Quantum Topology, I

3:00 p.m.–6:00 p.m.

- 3:00 p.m. *Quantum affine algebras and affine Hecke algebras.*  
(36) **Vijayanthi Chari**, University of California, Riverside (887-16-52)
- 3:30 p.m. *Quantizations of reductive lie algebras.*  
(37) **V. S. Varadarajan**, University of California, Los Angeles (887-81-23)
- 4:00 p.m. *Hopf algebra analogues of Lie algebra results.*  
(38) Preliminary report.  
**David Fischman\***, University of Southern California,  
**Miriam Cohen**, Ben-Gurion University of the Negev, Israel, and **Sara Westreich**, Ben Gurion University of the Negev, Israel (887-16-40)
- 4:30 p.m. Discussion

### Special Session on Mathematical Models in Epidemiology, II

3:30 p.m.–5:50 p.m.

- 3:30 p.m. *On models for prevalence of disease in populations structured by density of the disease.*  
(39) **Richard H. Elderkin**, Pomona College (887-92-63)
- 4:00 p.m. *A non-generational approach to the inheritance of social traits.*  
(40) **Sharon Lubkin\***, University of Washington, and **Carlos Castillo-Chavez**, Cornell University (887-92-08)
- 4:30 p.m. *The role of male and female preference on marriage functions in age-structured populations.* Preliminary report.  
(41) **Shu-Fang Hsu Schmitz\*** and **Carlos Castillo-Chavez**, Cornell University (887-92-20)
- 5:00 p.m. *Where in the world is the epidemic that Carmen Santiago started?*  
(42) **Lisa Sattenspiel**, University of Missouri, Columbia (887-92-48) (Sponsored by Carlos Castillo-Chavez)
- 5:30 p.m. *Persistence in Helicobacter Pylori.*  
(43) **Denise E. Kirschner\*** and **Martin Blaser**, Vanderbilt University (887-92-65) (Sponsored by Carlos Castillo-Chavez)

## Sunday, November 7

### Special Session on Dynamical Systems and Chaos, II

8:30 a.m.–10:30 a.m.

- 8:30 a.m. *Volterra's crusade against chaos.*  
(44) **Ray Redheffer**, University of California, Los Angeles (887-34-27)

- 9:00 a.m. *Positive fixed points for subhomogeneous monotone maps.*  
(45) **Morris W. Hirsch**, University of California, Berkeley (887-34-09)
- 9:30 a.m. *On some quadratic dynamical systems.* Preliminary report.  
(46) **Klaus Schmitt**, University of Utah (887-34-12)
- 10:00 a.m. *Unrestricted iterations of contractions.*  
(47) **Simeon Reich**, University of Southern California (887-47-28)

### Special Session on Nonlinear Analysis and Banach Space Theory, III

8:30 a.m.–9:50 a.m.

- 8:30 a.m. *Unrestricted products of contractions in Banach spaces.*  
(48) **Pei-Kee Lin**, Memphis State University (887-47-56) (Sponsored by Edward Odell)
- 9:00 a.m. *Stability of some properties in Banach spaces.*  
(49) **Elias Saab**, University of Missouri, Columbia (887-46-42)
- 9:30 a.m. Discussion

### Special Session on Mathematical Models in Epidemiology, III

9:00 a.m.–10:50 a.m.

- 9:00 a.m. *Asymptotical behavior of an S-I-S multiple group model with age-structure.*  
(50) **Wenzhang Huang**, Cornell University (887-92-45) (Sponsored by Carlos Castillo-Chavez)
- 9:30 a.m. *Can a core group allow for the coexistence of multiple strain of a non-fatal sexually-transmitted disease?*  
(51) **Jia Li\***, University of Alabama, Huntsville, **Carlos Castillo-Chavez**, Cornell University, and **Wenzhang Huang**, Georgia Technology (887-92-44)
- 10:00 a.m. *Multi-annual outbreaks of childhood diseases revisited: The possible effects of isolation.*  
(52) **Zhilan Feng** and **Horst R. Thieme\***, Arizona State University (887-92-05)
- 10:30 a.m. *Models for diseases with vertical transmission and nonlinear population dynamics.*  
(53) **Fred Brauer**, University of Wisconsin, Madison (887-92-19)

### Special Session on Industrial Applied Mathematics, II

9:00 a.m.–10:20 a.m.

- 9:00 a.m. *The exact confidence bound method: Use in marketing.*  
(54) **Steven P. Loudon**, Claremont McKenna College (887-62-67) (Sponsored by Robert E. Williamson)
- 9:30 a.m. *Lower confidence bounds on system reliability.*  
(55) **Darren M. Gonzales**, Claremont McKenna College (887-62-68) (Sponsored by Robert E. Williamson)

## Sunday, November 7 (cont'd)

- 10:00 a.m. *Reliability growth models.*  
(56) **David W. Ballew**, Claremont McKenna College  
(887-62-69) (Sponsored by Robert E. Williamson)

### Special Session on Computational Number Theory, III

#### 9:00 a.m.–10:20 a.m.

- 9:00 a.m. *Halfway to a solution of quadratic diophantine equation.*  
(57) **Alf van der Poorten**, Macquarie University, Australia  
(887-11-04)
- 9:30 a.m. *On the continued fractions of quadratic surds.*  
(58) **David G. Cantor**, Center for Communications  
Research, San Diego, California (887-14-58)
- 10:00 a.m. Discussion

### Special Session on Brownian Motion and Applications to Potential Theory, III

#### 9:45 a.m.–10:30 a.m.

- 9:45 a.m. *Boundary fluctuations in first-passage percolation.*  
(59) **Kenneth S. Alexander**, University of Southern  
California (887-60-41)

#### Invited Address

#### 11:00 a.m.–11:50 a.m.

- (60) *Morse theory up to  $\epsilon$ .*  
**Nassif Ghoussoub**, University of British Columbia  
(887-58-50)

#### Invited Address

#### 2:00 p.m.–2:50 p.m.

- (61) *On quantum groups.*  
**Nicolai Reshetikhin**, University of California, Berkeley  
(887-99-76)

### Special Session on Dynamical Systems and Chaos, III

#### 3:00 p.m.–4:50 p.m.

- 3:00 p.m. *Absence of limit cycles.*  
(62) **Pauline Van Den Driessche**, University of Victoria  
(887-34-32) (Sponsored by Mario U. Martelli)

- 3:30 p.m. *Complicated dynamics in a 4-level food chain.*  
(63) Preliminary report.  
**H. L. Smith\***, Arizona State University, and **Paul  
Waltman**, Emory University (887-35-14)
- 4:00 p.m. *Delay differential equations models vs. differential  
equations models – two case studies in biological  
modeling.*  
(64) **Betty Tang**, Arizona State University (887-92-30)
- 4:30 p.m. *Distributional and small solutions of delay equations.*  
(65) **K. L. Cooke\***, Pomona College, and **S. M. Verduyn  
Lunel**, Vrije University, Netherlands (887-34-24)

### Special Session on Brownian Motion and Applications to Potential Theory, IV

#### 3:00 p.m.–5:35 p.m.

- 3:00 p.m. *Coexistence results in catalysts.*  
(66) **R. Durrett**, Cornell University, and **G. Swindle\***,  
University of California, Santa Barbara (887-60-78)
- 3:55 p.m. *A discrete invariance principle for random  
combinatorial structures.*  
(67) **A. D. Barbour**, **R. Arratia** and **S. Tavaré\***, Institut für  
Angewandte Mathematik, Zurich, Switzerland  
(887-60-39) (Sponsored by Steven N. Evans)
- 4:50 p.m. *Particle representation of functionals of a  
superprocess.*  
(68) **Raisa E. Feldman\*** and **Srikanth K. Iyer**, University  
of California, Santa Barbara (887-60-29)

### Special Session on Quantum Groups and Quantum Topology, II

#### 3:00 p.m.–6:00 p.m.

- 3:00 p.m. Discussion and Problem Session

### Session on Contributed Papers

#### 3:00 p.m.–4:55 p.m.

- 3:00 p.m. *The content of boxes.* Preliminary report.  
(69) **G. D. Chakerian** and **M. A. Ghandehari\***, University  
of California, Davis (887-52-01)
- 3:15 p.m. *Representation theorems and continuous duals of  
paranormed sequence spaces generated by infinite  
matrices.*  
(70) **Nandita Rath**, Washington State University  
(887-40-02)
- 3:30 p.m. *The storage complexity of some estimators of the  
median.*  
(71) **Mark Finkelstein\*** and **Stephen Scheinberg**,  
University of California, Irvine (887-68-03)
- 3:45 p.m. *Fekete-Szegő problem for powers of strongly  
close-to-convex functions.*  
(72) **M. Jahangiri**, California State University, Bakersfield  
(887-30-43)
- 4:00 p.m. *Numerical integration by the inverse of derivative  
operator.*  
(73) **Krishnanand Verma**, University of Wisconsin,  
Whitewater (887-65-53) (Sponsored by Bennette R.  
Harris)

## Program of the Sessions

4:15 p.m. *A new perspective of trigonometric function.*  
(74) Preliminary report.  
**Kaninka Verma\*** and **Samarth Verma**, Whitewater High School, Wisconsin (887-33-54) (Sponsored by Bennette R. Harris)

4:30 p.m. *On a free boundary problem in porous media.*  
(75) **Gieri Simonett\***, University of California, Los Angeles, and **Joachim Escher**, University of Besancon, France (887-35-15)

4:45 p.m. *Existence, uniqueness, and stability of symmetric periodic solutions of a differential delay equation.*  
(76) **Anatoli F. Ivanov\***, University of Rhode Island, and **Srikanth K. Iyer**, University of California, Santa Barbara (887-34-21)

**Lance W. Small**  
Associate Secretary  
La Jolla, California

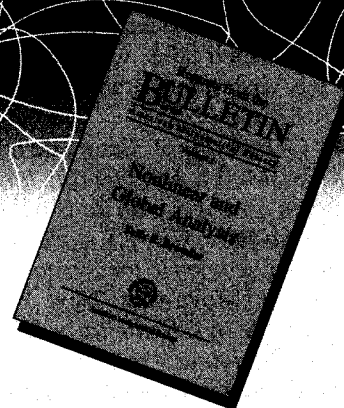
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# International Joint Mathematics Meeting

## Merida, Yucatan, Mexico, December 1–4, 1993

### Second Announcement

The first joint meeting of the AMS and the Sociedad Matemática Mexicana (SMM) will take place December 1–4, 1993, (Wednesday–Saturday) at the University of Yucatan, Merida, Mexico. The Program Committee was coordinated by AMS secretary Robert M. Fossum and includes L. Gorostiza, J. G. Gómez Larrañaga, and Jorge Ize from SMM; and Idun Reiten, Mary Ellen Rudin, and William Velez from AMS.

#### Invited Addresses

By invitation of the Program Committee there will be six invited addresses. The names and affiliations of the speakers and the titles of their talks, where available, are as follows:

**Maurice Auslander**, Brandeis University, *Representation theory of Artin algebras*;

**Xavier Gómez-Mont**, Centro de Investigación en Matemáticas A.C. (CIMAT), *An algebraic formula for the index of a vector field on a variety with an isolated singularity*;

**Luis Montejano**, CIMAT, *Some applications of topology to the theory of geometric tomography*;

**Cathleen S. Morawetz**, New York University-Courant Institute, *The role of self-similar solutions for solving Euler's equations for fluid flow*;

**Daniel W. Stroock**, Massachusetts Institute of Technology, *Gibb states, where they come from*;

**William P. Thurston**, Mathematical Sciences Research Institute, *title to be announced*.

#### Special Sessions

By invitation of the same committee there will be nine special sessions of selected twenty-minute papers. The topics of these sessions and the names and affiliations of the organizers are as follows:

*Representations of algebras*, **Raymundo Bautista**, Instituto de Matemáticas, Universidad Nacional Autónoma de México (UNAM) and **Idun Reiten**, University of Trondheim;

*Graphs and combinatorics*, **Gilberto Calvillo Vives**, Banco de México, and **Joseph P. Kung**, University of North Texas;

*Asymptotic and numerical methods in mechanics and biology*, **Carlos Castillo-Chavez**, Cornell University, and **Cristóbal Vargas Jarillo**, Centro de Investigación y Estudios Avanzados (CINVESTAV), Instituto Politécnico Nacional (IPN);

*Nonlinear analysis*, **Michael G. Crandall**, University of California, Santa Barbara; **Jorge Ize**, Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas, UNAM; and **Monica Clapp Jiménez**, Instituto de Matemáticas, UNAM;

*Holomorphic systems and geometry*, **Xavier Gómez-Mont**, and **Domingo Toledo**, University of Utah;

*Geometric topology in low dimensions*, **Francisco J. González-Acuña**, Instituto de Matemáticas, UNAM; **C. M. Gordon**, University of Texas at Austin; and **Jonathan K. Simon**, University of Iowa;

*Stochastic analysis*, **Luis Gorostiza**, CINVESTAV, IPN; **Thomas G. Kurtz**, University of Wisconsin; and **Victor M. Pérez-Abreu Carrión**, CIMAT;

*Noncommutative rings*, **Sergio R. Lopez-Permouth**, Ohio University; **Francisco Raggi Cárdenas**, Instituto de Matemáticas, UNAM; and **José Ríos Montes**, Instituto de Matemáticas, UNAM;

*General topology*, **Jerry E. Vaughan**, University of North Carolina at Greensboro, and **Richard Wilson**, Universidad Autónoma Metropolitana, Unidad Iztapalapa.

The deadline for submission of abstracts for consideration in any of these sessions has expired.

#### Workshops

Also by invitation of the Program Committee there will be at least one workshop, *Technology in the classroom*, organized by **David Lomen**, University of Arizona.

#### Contributed Paper Sessions

There will be sessions of ten-minute contributed papers. The deadline for submission of abstracts for these sessions has expired. Unfortunately, late papers cannot be accommodated.

#### Registration

Registration will be open on Wednesday from 9:00 a.m. to 6:00 p.m.; on Thursday and Friday from 9:00 a.m. to 1:30 p.m. and 5:00 p.m. to 8:00 p.m.; and on Saturday, from 10:00 a.m. to 1:00 p.m. The registration desk will be in the central yard of the university's main building. The registration fee is US\$30 for all participants.

#### Social Events

The SMM cordially invites all registered participants to a complimentary reception on Wednesday evening. On Thursday an informal snack bar with show will be offered. Both events will be held in the university's main building at 8:45 p.m.

A conference dinner with an after-dinner show included will take place on Friday at 9:00 p.m. Interested participants must make reservations at the registration desk. Cost is about US\$25 per person.



Also, arrangements have been made for a tour to the archaeological zone of Uxmal at 2:00 p.m. on Saturday. Tickets are about US\$40 each and will be available at the registration desk.

### Accommodations

**Los Aluxes** and **Casa del Balam** are five-star hotels that have been selected as the official hotels for the meeting. A limited number of rooms have been blocked at special rates. Participants should make their own reservations directly with the hotels by **November 24, 1993**. Be sure to mention the AMS-SMM meeting. Prices are quoted in U.S. dollars and include taxes and chambermaid tips; porter service is an extra US\$2. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels.**

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Those who would like accommodations other than at the official hotels are encouraged to contact either their local travel agent or Viajes Alvaro, the official travel management company for the meeting (telephone: 52-5-370-2803 or 5996; fax: 52-5-370-5824).

### Travel

Continental has been declared the official airline for this meeting. Special airfares include a 25% discount off the full "Y" or "F" class fares or a 5% discount off the lowest applicable fare. Please call Continental at 1-800-468-7022 Monday through Friday, 6:00 a.m. to 11:59 p.m., and Saturday and Sunday, 8:00 a.m. to 9:00 p.m., for reservations and details of applicable restrictions if any. Refer to Easy Access Number ZMW17. Once reservations have been made, tickets may be purchased from any licensed travel agency, Continental ticket office, or airport ticket counter.

Merida International Airport is served by several direct flights from Houston, Miami, and Mexico City. Viajes Alvaro will be happy to assist you with airline reservations. Ground transportation from the airport is available on an individual (about US\$25) or collective (about US\$7) basis.

### Local Information

Merida, a beautiful city founded by the Spaniards in 1542, where the Mayans left rich cultural traditions, is situated in the eastern part of the country, some 1500 km from Mexico City.

Participants will have an opportunity to explore archaeological sites; enjoy the natural beauty of the "cenotes"; and discover handicraft shops, museums, theaters, parks, restaurants, and colonial architecture.

The climate is a combination of tropical and semidry. In December the sky is sunny and cloudless. While it is rather warm during the day, it cools off in the evening. Daily average temperatures are between 68°F (20°C) and 86°F (30°C).

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# Joint Mathematics Meetings, Cincinnati, Ohio January 12–15, 1994

*First Announcement*



Cincinnati skyline. (Photo courtesy of the Cincinnati Convention Bureau.)

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## The Scientific Program

The January 1994 Joint Mathematics Meetings, including the 100th Annual Meeting of the AMS, the 77th Annual Meeting of the Mathematical Association of America, and the 1994 annual meetings of the Association for Women in Mathematics and the National Association for Mathematicians, will be held January 12–15 (Wednesday–Saturday), 1994, in Cincinnati, Ohio. Sessions will be held in the Cincinnati Convention Center (CCC), the Clarion Hotel Cincinnati, and the Hyatt Regency Cincinnati.

Several events have been planned to celebrate this 100th Annual Meeting of the AMS. See page 1031 for details and look for this symbol  $\text{AMS}$  throughout this announcement.

### AMS-MAA Invited Addresses

Four speakers will address the AMS and MAA on the history or development of mathematics:

**Georgia M. Benkart**, University of Wisconsin, Madison, *A tale of two groups*, 11:10 a.m., Wednesday;

**Subrahmanyam Chandrasekhar**, University of Chicago, *Some propositions from Newton's Principia*, 11:10 a.m., Friday;

**László Lovász**, Eötvös Loránd Tudományegyetem, *Random walks and volume*, 11:10 a.m., Thursday; and

**Kenneth A. Ribet**, University of California, Berkeley, *Overview and update on Fermat's Last Theorem*, 4:25 p.m., Wednesday.

### Other AMS-MAA Sessions

**Mathematics and Education Reform:** This jointly sponsored Special Session has been organized by **Naomi Fisher** and **Philip D. Wagreich**, University of Illinois at Chicago; **Harvey B. Keynes**, University of Minnesota, Minneapolis; **Kenneth C. Millett**, University of California at Santa Barbara; and **Hugo Rossi**, University of Utah, on Wednesday at 8:00 a.m. and 2:15 p.m., and Thursday at 2:15 p.m. This session is also cosponsored by the Mathematicians and Education Reform (MER) Network. This session will feature presentations to highlight the range of education reform projects in which mathematicians are engaged and systemic issues which relate to pursuing educational reform within the mathematics community. As in the past part of the session will highlight themes from recent MER workshops. This year's theme is *Mathematics Departments and Education Reform*.

**Effective Job Seeking in Today's Market:** This panel discussion sponsored by the AMS-MAA-SIAM Committee on Employment Opportunities (JCEO) and moderated by **Stanley J. Benkoski**, Wagner Associates and chair of the JCEO, will take place on Wednesday, 2:00 p.m. to 3:15 p.m. All graduate students and mathematicians seeking employment

are encouraged to attend. Four informational presentations are intended to advise job seekers of the realities of the current market and the best methods for determining what they should seek and how to carry out various steps in the employment process most effectively. A question-and-answer period will follow brief presentations. Panelists include **Annalisa Cranell**, Franklin and Marshall College (recent Ph.D. recipient); **Ronald Davis**, Anoka-Ramsey Community College (on the two-year college experience); **Frank R. Demeyer**, Colorado State University (Ph.D.-granting department); **S. Brent Morris**, National Security Agency (on government employment); and **Leon H. Seitelman**, Pratt & Whitney Aircraft (on industrial employment).

**What Can Be Done About Employment of Mathematicians in the 90s and Beyond?:** This panel discussion on the employment situation scheduled for Friday from 5:00 p.m. to 6:15 p.m. is cosponsored by the JCEO and the Young Mathematicians Network (YMN). The panel will be moderated by **Stanley J. Benkoski**. Panelists will focus on aspects of the current job market for mathematicians, addressing such questions as whether departments are producing too many mathematicians, whether mathematicians are receiving the wrong training in graduate school, and what responsibility the mathematics community has in addressing these issues.

Attendees are invited to an informal reception hosted by the AMS and the MAA after the conclusion of the panel in order to become better acquainted with panel members, the JCEO, and the YMN.

### Other AMS-MAA Events

**Mathchats and Graduate Student Reception:** On Tuesday evening well-known mathematicians representing a wide range of disciplines (Tom Banchoff, Fan Chung, Ingrid Daubechies, Bob Devaney, Keith Devlin, John Ewing, Florence Fasanelli, Genevieve Knight, Jeff Lagarias, Jim Lightbourne, Eileen Poiani, Fred Rickey, Ken Ross, Martha Siegel, and others) will join interested graduate students for informal chats and all graduate students are invited. Departure is at 6:00 p.m. on Tuesday from the CCC for a short tour of Cincinnati by trolley, then on to SkyLine Chili for a buffet supper. Return will be about 9:00 p.m.

NOTE: This event is for students only. There is no cost. However, interested students must sign up on their advance registration forms.

**Social for First-time Attendees:** The AMS Committee on Membership (Hugo Rossi, chair) and the MAA Committee on Membership (Shirley Huffman, chair) are again 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.

### IMPORTANT DEADLINES

AMS Abstracts	
For Consideration for Special Sessions	Expired
Of Contributed Papers	October 1
MAA Abstracts of Contributed Papers	Expired
EARLY Meetings Advance Registration and Housing (Room Lottery)	October 29
ORDINARY Meetings Advance Registration/Housing/Tickets	November 12
Employment Register Advance Registration	November 12
MAA Minicourse Advance Registration	November 12
Hotel Changes and Cancellations with MMSB	December 10
FINAL Employment Register with no Winter Lists listings	December 13
FINAL Meetings Advance Registration (no housing or tickets)	December 13
Motions for AMS Business Meeting	December 14
Cancellations for all Banquets (50% refund)	December 30
Advance Registration Cancellations (50% refund)	January 9


**Joint Prize Session and Reception:** In order to showcase the achievements of the recipients of various prizes, 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. AMS will announce the recipients of the Bôcher Prize and AMS Citations for Public Service.

The MAA Prizes to be awarded include the Distinguished Teaching Awards, the Chauvenet Prize, the Beckenback Book Prize, the Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics, and several Certificates of Meritorious Service.

**Dramatic Presentation:** The play *Gauss, Eisenstein, and the "third" proof of the quadratic reciprocity theorem: Ein kleines Schauspiel* will be performed from 8:45 p.m. to 9:30 p.m. on Friday by **Reinhard C. Laubenbacher** and **David J. Pengelley**, New Mexico State University. The setting is an imaginary dialogue between Gauss and Eisenstein taking place in the year 1844.

## 100th Annual Meeting of the AMS January 12–15, 1994


### 100 Years of Annual Meetings

 On Saturday the Society will celebrate 100 years of Annual Meetings. The Special Committee on the 100th Annual Meeting preparing the program for this milestone event earlier called for suggestions. Suggestions can still be communicated to its members (see the display at the bottom of the following page). All participants are invited to join in the activities planned to mark this unique occasion. Plans are also being made for the taking of group photographs of Cincinnati participants. Since it will not be possible to photograph the entire attendance at once, several photo sessions (probably by geographic area) will be necessary. A schedule of these sessions will be announced in the program.

### Invited Addresses

**Sixty-seventh Josiah Willard Gibbs Lecture:** The 1994 Gibbs Lecture titled *Necessity and chance: deterministic chaos in ecology and evolution* will be presented at 8:30 p.m. on Wednesday by **Robert M. May**, University of Oxford.

**Colloquium Lectures:** A series of three Colloquium Lectures on *Harmonic analysis and nonlinear evolution equations* will be given by **Jean Bourgain**, IHES and University of Illinois, Urbana-Champaign. The lectures will be given at 1:00 p.m. daily, Wednesday through Friday.

 **Retiring Presidential Address:** **Michael Artin**, MIT, will deliver his Retiring Presidential Address, *Noncommutative projective geometry*, at 1:00 p.m. on Saturday. Artin was president of the Society from 1991 to 1992. **Ronald L. Graham**, AT&T Bell Labs and current AMS president, will introduce Artin and comment about traditional lecture series at AMS meetings.

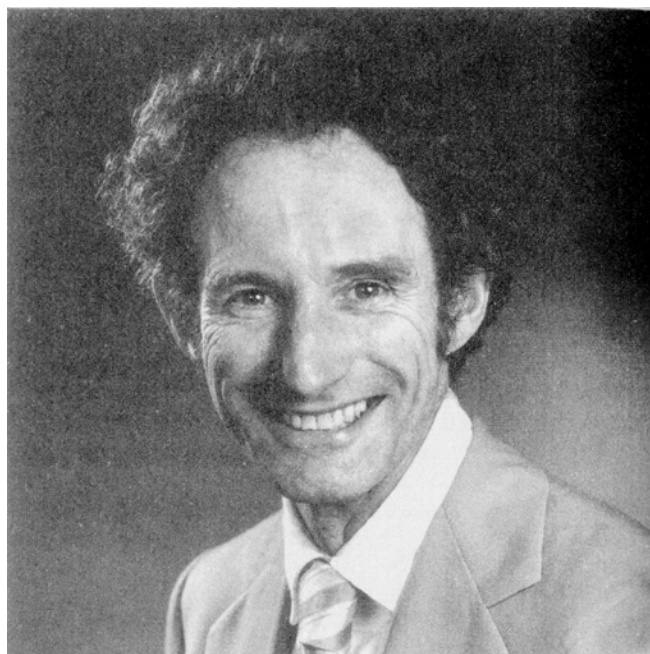
**Jacques C. Hurtubise**, McGill University, *Particle configurations, instantons, and holomorphic maps*, Wednesday, 10:05 a.m.;

**James M. Hyman**, Los Alamos National Lab, *The fundamental role of solitons in nonlinear dispersive PDEs*, Thursday, 3:20 p.m.;

**Carl Pomerance**, University of Georgia, *Carmichael numbers*, Friday, 9:00 a.m.;

**Gilbert Strang**, MIT, *Wavelets, filters, and unitary matrices*, Friday, 10:05 a.m.; and

**Ruth J. Williams**, University of California, San Diego, *Reflecting Brownian motions*, Thursday, 2:15 p.m.



Robert M. May, Gibbs Lecturer

### Special Sessions and Contributed Papers


(See also the AMS-MAA Special Session.)

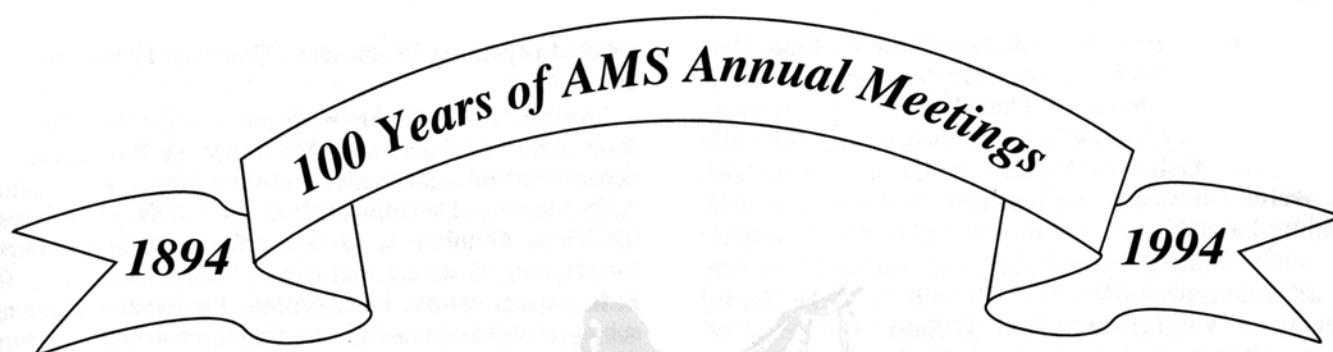
*Topology of high dimensional manifolds*, **Fredric D. Ancel**, University of Wisconsin-Milwaukee, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. and 2:15 p.m. on Saturday.

*History of mathematics*, **W. Thomas Archibald**, Acadia University, and **Victor J. Katz**, University of the District of Columbia, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. on Saturday.

*Algebraic topology and dynamical systems*, **Robert Brown**, University of California, Los Angeles; **Christopher K. McCord**, University of Cincinnati; and **Konstantin Mischaikow**, Georgia Tech, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Undergraduate research in mathematics*, **David C. Carothers**, Hope College, and **Gerard A. Venema**, Calvin College, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. and 2:15 p.m. on Saturday.

 *Meetings of mathematicians*, **Bettye Anne Case**, Florida State University, 1:00 p.m. on Friday, and 9:00 a.m. and 3:15 p.m. on Saturday.



The program includes these exciting events:

- **CELEBRATION: 1894–1994**  
*A special opening ceremony featuring Everett Pitcher and John Green, former AMS secretaries, followed by a reception and light lunch.*
- **RETIRING PRESIDENTIAL ADDRESS**  
*Michael Artin's Retiring Presidential Address, introduced by President Graham with comments about traditional meeting lecture series.*
- **SPECIAL SESSION—MEETINGS OF MATHEMATICIANS**  
*Discussions of the history of mathematics related to meetings, organized by Bettye Anne Case, chair of the Special Committee on 100 Years of Annual Meetings.*
- **FUTURE MATHEMATICS MEETINGS: IS CHANGE DESIRABLE?**  
*A panel discussion intended to gather information about needs and opportunities for future meetings, led by Hugo Rossi, former AMS associate secretary and chair of the new Committee on Meetings and Conferences.*
- **SPECIAL PUBLICATIONS EXHIBIT**  
*Books on the history of mathematics on display at the AMS exhibit.*
- **NOSTALGIC PHOTOGRAPHS**  
*Special display of photographs and mementos of AMS meetings past. Cincinnati group photos planned for posterity.*
- **AMS BANQUET**  
*The perfect ending to a day of celebration! Cocktails and dinner with a humorous overview of AMS meetings. Members of twenty-five or more years will be recognized, and prizes will be awarded.*

Planning committee

**Richard A. Askey**, University of Wisconsin  
**Paul T. Bateman**, University of Illinois  
**Bettye Anne Case**, Florida State University (Chair)  
**W. Wistar Comfort**, Wesleyan University

**Robert J. Daverman**, University of Tennessee  
**Robert M. Fossum**, University of Illinois  
**Everett Pitcher**, Lehigh University  
**Janice B. Walker**, Xavier University



*Singular boundary value problems*, **Paul W. Eloe**, University of Dayton, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Operator theory, nonself adjoint operator algebras and control theory*, **Arthur E. Frazho**, Purdue University, and **Gary Weiss**, University of Cincinnati, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Representation theory and harmonic analysis*, **Kenneth I. Gross**, University of Vermont; **Donald St. P. Richards**, University of Virginia; and **Paul J. Sally**, University of Chicago, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*C\*-algebras and von Neumann algebras*, **Herbert Halpern**, **Victor Kaftal**, and **Shuang Zhang**, University of Cincinnati, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. and 2:15 p.m. on Saturday.

*Quasiconformal mappings in analysis*, **David A. Herron**, University of Cincinnati, and **Susan G. Staples**, College of Staten Island, CUNY, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. and 2:15 p.m. on Saturday.

*Geometry and topology of moduli spaces*, **Jacques C. Hurtubise**, 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Geometric applications of operator algebras and index theory*, **Jerome Kaminker**, Indiana University-Purdue University at Indianapolis, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Modern methods in continuum theory*, **Krystyna M. Kuperberg** and **Piotr Minc**, Auburn University, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. and 2:15 p.m. on Saturday.

*Quadratic forms and division algebras*, **David B. Leep**, University of Kentucky; **Daniel B. Shapiro**, Ohio State University; and **Tara L. Smith**, University of Cincinnati, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Advances in function theoretic methods*, **Peter A. McCoy**, U. S. Naval Academy, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Stochastic analysis*, **Philip E. Protter**, Purdue University, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. and 2:15 p.m. on Saturday.

*Scientific computing*, **Seenith Sivasundaram**, Embry-Riddle Aeronautical University, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. on Saturday.

*Wavelets and their applications*, **Gilbert Strang**, MIT, 8:00 a.m. and 2:15 p.m. on Wednesday, and 8:00 a.m. and 2:15 p.m. on Thursday.

*Nonlinear partial differential equations and applications*, **Hong-Ming Yin**, Notre Dame University, 8:00 a.m. and 1:00 p.m. on Friday, and 8:00 a.m. and 2:15 p.m. on Saturday.

Abstracts for consideration for presentation in one of these sessions should have been submitted by **September 9, 1993**, three weeks earlier than the deadline for contributed papers.

**Contributed Papers:** There will be sessions for con-

tributed papers on Wednesday, Thursday, Friday, and Saturday.

Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics and should be sent to Abstracts, AMS Meetings Department, P. O. Box 6887, Providence, RI 02940, by **October 1, 1993**. A charge of \$16 is imposed for retyping abstracts that are not in camera-ready form. **Late papers cannot be accepted.** Participants planning to submit abstracts for AMS ten-minute contributed papers by the **October 1** deadline should be sure to indicate on the abstract any special scheduling requests. Failing that, these requests should be communicated to the AMS Associate Secretary, Robert Daverman, Department of Mathematics, University of Tennessee, Knoxville, TN 37996-1300, e-mail: [g.daverman@math.ams.org](mailto:g.daverman@math.ams.org).

**Electronic Submission of Abstracts:** This service is available to those who use the  $\text{\TeX}$  typesetting system. Requests to obtain the package of files may be sent by electronic mail on the Internet to [abs-request@math.ams.org](mailto:abs-request@math.ams.org). Requesting the files electronically will likely be the fastest and most convenient way, but users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to: Electronic Abstracts, American Mathematical Society, Meetings Department, P.O. Box 6887, Providence, RI 02940. When requesting the Abstracts package, users should be sure to specify whether they want the plain  $\text{\TeX}$ ,  $\text{\AA\MS-TeX}$ , or the  $\text{\LaTeX}$  package. Again, late papers cannot be accepted.

### Other AMS Sessions

**The Place of Mathematics in National Science and Technology Goals:** The Committee on Science Policy (CSP) (Frank W. Warner III, chair) will sponsor this panel on Wednesday, 2:15 p.m. to 4:00 p.m.

The Committee on Science, Engineering, and Public Policy (COSEPUP) of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine recently issued a report, "Science, Technology and the Federal Government: National Goals for a New Era", proposing specific national goals for science and technology, designed to ensure that U.S. science be among the world leaders in all areas and clearly in first place in areas essential to the national well being. New assessment mechanisms are proposed that would lead to a determination of support levels for the various fields of science to achieve these goals. The panel will discuss how this report might affect mathematics. Should the U.S. be first in the world in mathematics or just among the world leadership? There are controversial recommendations depending upon the outcome of such a decision, one being possibly even less federal support of mathematics.


As part of the attempt to help position the mathematical sciences to fulfill its enabling role for all of science and technology and to be recognized as essential to national well being, the AMS is preparing the first in a planned series of Federal Policy Agendas. The purpose of the agenda is to




articulate and prioritize public policy issues of concern to the mathematical community and to inform the membership, policy makers, and the public on these issues. The CSP invites you to participate in a panel presentation and discussion of the role the mathematical sciences can play in the national science and technology goals and the actions required of the discipline to secure the support required for achieving its enabling role. Panel members include **Hyman Bass**, Columbia University (chair of the Mathematical Sciences Education Board and member of the Federal Policy Agenda subcommittee of CSP); **Phillip A. Griffiths**, director of the Institute for Advanced Study and chair of COSEPUP; **John C. Polking**, Rice University (chair of the Board of Trustees of the AMS and member of CSP and its Federal Policy Agenda subcommittee); and **Margaret H. Wright**, AT&T Bell Labs (vice-president of SIAM and member of the Federal Policy Agenda subcommittee of CSP). **Frank W. Warner**, University of Pennsylvania, Philadelphia, will serve as moderator.

**TEX Presentation:** On Friday from 8:00 a.m. to 10:55 a.m. AMS technical staff will host discussions on TEX-related topics such as electronic submission of manuscripts, the advantages this brings to authors and readers, and the ways in which AMS-TEX and AMS-LATEX support that process. Staff will demonstrate the use of AMS-TEX and AMS-LATEX in the preparation of a manuscript for electronic submission. A question-and-answer session will follow each presentation.

**Impact of Electronic Publications on the Mathematics and Library Communities:** This panel discussion jointly sponsored by the Library Committee (Nancy Anderson and James L. Rovnyak, co-chairs) and the Electronic Products and Services Committee (EPSC) (John L. Franks, chair) is scheduled from 1:00 p.m. to 2:30 p.m. on Friday. The panel will consist of a mathematician, a librarian, and representatives from the EPSC and e-MATH, each discussing the ramifications of electronic products on themselves or on those they serve. A question-and-answer period will follow.

 **Celebration of 100 Years of AMS Meetings:** On Saturday from 11:10 a.m. to 12:20 p.m. participants will be treated to an opening ceremony and commemoration marking this momentous occasion, featuring **Everett Pitcher**, Lehigh University, and **John W. Green**, University of California, Los Angeles, both former AMS secretaries.

All participants are invited to a buffet offering light refreshments immediately after the conclusion of the ceremonies. We hope participants will take this opportunity to renew old acquaintances.

 **Future AMS Meetings:** This panel discussion scheduled on Saturday from 2:15 p.m. to 3:00 p.m. and moderated by **Hugo Rossi**, University of Utah, is intended to gather information about the needs and opportunities for future meetings. The moderator is a former AMS associate secretary and chair of the new Committee on Meetings and Conferences.

### Other AMS Events

**Mathematical Reviews Reception:** There will be a reception for reviewers (past and present) for *Mathematical Reviews* (MR), on Friday, January 14, from 5:30 p.m. to 6:30 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:** The Council of the Society will meet at 1:00 p.m. on Tuesday.

**Business Meeting:** The Business Meeting of the Society will take place 12:10 p.m. on Friday. The Business Meeting of January 1993 placed on this agenda a resolution concerning the Strategic Planning by the Society proposed by Saunders Mac Lane. The precise details of the resolution will appear in the next announcement of this meeting.

**Agenda: Report of the Secretary, Resolution by Saunders Mac Lane, 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 14, 1994, receive the service offered by the committee in the most effective manner, it should be in the hands of the secretary by December 14, 1993.



## 77th Annual Meeting of the MAA January 12–15, 1994

### Invited Addresses

**Retiring Presidential Address:** Past President **Deborah Tepper Haimo**, University of Missouri at St. Louis, will give her Retiring Presidential Address titled *Experimentation and conjecture are not enough* at 2:15 p.m. on Friday.



Deborah Tepper Haimo, MAA Retiring Presidential Address

**Deane Arganbright**, Whitworth College, *Mathematics and the ubiquitous spreadsheet: visualization, conceptualizations, and applications*, Wednesday, 2:15 p.m.;

**William W. Dunham**, Muhlenberg College, *Euler's extraordinary sums*, Saturday, 10:05 a.m.;

**Stephen Monk**, University of Washington, *What does it mean to understand a mathematical concept? It depends on your point of view*, Thursday, 10:05 a.m.; and

**Brad G. Osgood**, Stanford University, *Circle packing and conformal mapping*, Wednesday, 3:20 p.m.

### Minicourses

**Minicourse #1:** *Organizing an undergraduate research program*, **Robert O. Robson**, Oregon State University, and **Joseph A. Gallian**, University of Minnesota, Duluth. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 4:30 p.m. to 6:30 p.m. on Wednesday. Enrollment is limited to 40.

This workshop will focus on the practical aspects of starting and running a successful undergraduate research program. Topics will include designing or choosing projects, reasonable goals for a program, organizational hints, obtaining funding and negotiating with administrators, following up on a program, and evaluating a program. We will consider

programs of all sizes, summer programs, and programs run during the academic years. Participants will spend a portion of the time in smaller interest groups discussing sample undergraduate research projects.

**Minicourse #2:** *Inverse problems in the undergraduate classroom*, **Charles W. Groetsch**, University of Cincinnati, and **Zuhair Nashed**, University of Delaware. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 4:30 p.m. to 6:30 p.m. on Wednesday. Enrollment is limited to 30.

Inverse problems may be loosely defined as problems of finding a cause of a given effect or of finding a model of a given cause-effect relationship. Such problems are vitally important in modern technology and can be used to great effect in engaging student interest. The course will identify examples, models, and topics in inverse problems suitable for various undergraduate courses and student projects. Prerequisites are elementary differential equations and linear algebra. It is recommended that participants bring a graphics calculator.

**Minicourse #3:** *The Joy of Mathematica: a point-and-click way to use and learn Mathematica*, **Alan H. Shuchat** and **Frederic W. Shultz**, Wellesley College. Part A: 8:00 a.m. to 10:00 a.m. on Wednesday, and Part B: 4:30 p.m. to 6:30 p.m. on Wednesday. Enrollment is limited to 30.

Hands-on introduction to the *The Joy of Mathematica*, software for the Macintosh that makes *Mathematica* useable "right out of the box". *Joy* runs concurrently with *Mathematica*, giving the option of substituting menus and dialog boxes for typing commands. Participants will learn to use *Joy* while exploring topics in calculus and linear algebra. They will see how *Joy* can enhance both traditional and "reformed" courses, with students and faculty knowing only the most basic Macintosh techniques.

**Minicourse #4:** *How to make effective use of inexpensive pocket computers to develop the concepts and techniques of calculus*, **Franklin D. Demana** and **Bert K. Waits**, Ohio 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 is limited to 40.

Inexpensive (\$100 or less) pocket computers are dramatically changing the way we teach and the way students learn calculus. Participants will use the latest "state-of-the-art" Texas Instruments pocket computers, powerful tools that permit the user to make and test generalizations by looking at a large number of examples quickly. This makes solving graphically and numerically a realistic and powerful problem-solving technique and makes noncontrived examples routine for all students. Topics include limits, continuity, differentiation, integration, optimization, sequences, series, vectors, matrices, and motion simulation.

**Minicourse #5:** *Unifying themes for discrete mathematics*, **Ralph P. Grimaldi**, Rose-Hulman Institute of Technology. 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 is limited to 80.

As discrete mathematics courses impact the college curricula, some students express concern about the apparent fragmented nature of the concepts. To dispel this feeling of

fragmentation certain unifying themes can serve to interrelate different concepts. Among such themes are

(i) the function—with its role in enumeration, the analysis of algorithms, finite state machines, and the preservation of discrete structures.

(ii) enumeration—as it reinforces the study of partial orders, equivalence relations, graph theory, and summation formulas.

**Minicourse #6:** *The mathematics of the perfect shuffle*, **S. Brent Morris**. 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 is limited to 80.

This minicourse examines the mathematics of the perfect shuffle, a permutation often used by mathematicians, magicians, and computer scientists for seemingly different ends. The perfect shuffle has broad appeal because of its interesting mathematics and surprising applications to magic tricks and computer design. Most of the mathematics should be accessible to those having some knowledge of discrete mathematics. The basic shuffle and several generalizations will be introduced, and the group structure generated by perfect shuffles will be explored. Participants will be taught several card tricks using different properties of the perfect shuffle. The minicourse will conclude with a study of computer circuits using the perfect shuffle interconnection. Each participant should bring a new deck of cards.

**Minicourse #7:** *Theorist*, **Donald Hartig**, California Polytechnic State University. 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 is limited to 30.

*Theorist* is the first commercially available computer algebra system for the Macintosh, taking advantage of intuitive features built into Apple's operating system (see Raymond Smith's review in the *Notices*, Volume 38, Number 10). After acquiring a working knowledge of the system, participants, working in pairs on a Macintosh computer, will have the opportunity to learn how *Theorist* can be used effectively in their classrooms. Sample electronic notebooks, lab assignments, and demonstrations suitable for courses in calculus, differential equations, and linear algebra will be distributed. Bring a blank diskette.

**Minicourse #8:** *Introduction to research in the teaching and learning of undergraduate mathematics: examples in calculus*, **Joan Ferrini-Mundy**, University of New Hampshire, and **Kathleen Heid**, The Pennsylvania State University, University Park. Part A: 8:00 a.m. to 10:00 a.m. on Thursday, and Part B: 8:00 a.m. to 10:00 a.m. on Saturday. Enrollment is 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 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 to those interested in "getting started" in research of this nature will be provided. "Homework" between sessions is planned.

**Minicourse #9:** *The math modeling/precalculus reform project: using discrete mathematical models to motivate mathematics*, **Sheldon P. Gordon**, Suffolk Community College, and **B. A. Fusaro**, Salisbury State University. Part A: 8:00 a.m. to 10:00 a.m. on Thursday, Part B: 8:00 a.m. to 10:00 a.m. on Saturday. Enrollment is limited to 80.

Under support from NSF, the *Math Modeling/Precalculus Reform Project* is developing an alternative to precalculus courses which emphasizes the broad applicability of mathematics using mathematical modeling based on methods such as difference equations, data analysis, probability, and matrix algebra. The ideas and skill needed for calculus are developed in the context of solving interesting and important problems. The minicourse will provide an overview of the project and its goals as well as illustrations and hands-on experience with some specific models based on difference equations, data analysis for fitting nonlinear curves to data, and probability simulations that have been developed for the course. Copies of the project materials will be provided to all participants.

**Minicourse #10:** *q-dimensional dynamical systems and chaos*, **Mario U. Martelli**, California State University, Fullerton. 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 is limited to 40.

This minicourse will provide detailed information on a course designed for undergraduates. A team project is an integral part of the course. Emphasis is on the long-range behavior of orbits and on the theoretical and computational devices for detecting chaos. Graphical and numerical techniques are included in the minicourse. Samples of completed projects will be available to the participants. *Mathematica* on a Macintosh is used in the presentation, but everything can be adapted to other machines and different symbolic manipulators.

**Minicourse #11:** *HP 48 learning environments for experienced users*, **Lynn E. Garner**, Brigham Young 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 is limited to 80.

This minicourse discusses "environments" for using the HP 48 as a "learning tool". In addition to built-in special-purpose environments such as graphics and matrix manipulation, we discuss several "homemade" environments useful in calculus, linear algebra, and numerical analysis that let students transform the HP 48 into a "doing tool" as they learn. Participants are expected to bring their own HP 48s.

**Minicourse #12:** *Creating order out of chaos in freshman mathematics*, **Wade Ellis, Jr.**, West Valley 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 is limited to 40.

Members of the MAA Committee on Testing will present an overview of the task of designing and implementing a mathematics placement program. Topics covered will include reasonable expectations of a placement program, selection or creation of placement tests, tests available through the MAA

Placement Test Program (PTP), statistical analysis of tests and test items, establishing cutoff scores, and administration and validation of a placement program. Several placement models will be presented.

**Minicourse #13:** *"Workshop" mathematics: using new pedagogy and technology in introductory mathematics courses*, **Nancy Hood Baxter** and **Allan Rossman**, Dickinson 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 is limited to 30.

Participants in this minicourse will receive an in-depth look at the "workshop" pedagogical approach and its underlying research activities. The major component of the minicourse will be participants' hands-on experience working in small groups with sample workshop materials taken from courses in quantitative reasoning, statistics with applications, and calculus with applications I and II. Participants will use a variety of software packages. Issues concerning designing workshop materials and implementing the approach will be discussed. In the workshop approach, lectures are replaced by interactive teaching where students learn by doing and then reflect on what they have done. Students are first introduced to fundamental concepts in an informal and intuitive way; then they work collaboratively on various activities. Complete sets of instructional materials for the courses mentioned above will be available. No previous computer experience is necessary.

**Minicourse #14:** *Interactive computer graphics laboratories for introductory differential geometry*, **Thomas F. Banchoff**, Brown 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 is limited to 80.

Interactive electronic book technology makes it possible for students to investigate phenomena in the geometry and calculus of surfaces by participating in computer graphics laboratories. The purpose of this minicourse is to examine the potential of this medium for enhancing the visualization capability of undergraduates in mathematics and its applications. The laboratory modules we will be studying have been written in a language developed by the presenter and his students at Brown University, and it is designed to run on any computer with X-windows capability. No previous computer experience is necessary to use this software.

**Minicourse #15:** *Designing question-based mathematics courses*, **Lawrence E. Copes** and **Su Dorée**, Augsburg College. 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 is limited to 80.

Do you find yourself frustrated when your students ask, "Why is this important?" Do your colleagues in other disciplines complain that your former students don't seem to understand the ideas you taught them? Perhaps you are answering questions that students haven't asked, questions to which they aren't ready to hear answers. In this minicourse you will learn to design class sessions and courses in which students ask questions before they learn answers. The result will be more meaningful learning.

**Minicourse #16:** *Calculus: an active approach with*

*projects*, **Stephen R. Hilbert**, **John C. Maceli**, **Diane D. Schwartz**, **Stanley E. Seltzer**, and **Eric E. Robinson**, Ithaca College. Part A: 3:15 p.m. to 5:15 p.m. on Friday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment is limited to 80.

This minicourse will address issues relating to the use of group projects and in-class activities in calculus, including an overview, examples of projects and activities, hands-on experience working in a group on projects and activities, and the impact on the curriculum. The organizers, who have been teaching calculus using group projects and in-class activities since spring 1989, have found that open-ended projects challenge students to develop problem-solving skills beyond looking for a similar problem solved in the text or class notes. They use in-class activities to help the students to become active learners and to develop the skills to successfully complete the projects.

**Minicourse #17:** *Teaching applied math via Maple*, **Robert J. Lopez**, Rose-Hulman Institute of Technology. Part A: 3:15 p.m. to 5:15 p.m. on Friday, and Part B: 3:15 p.m. to 5:15 p.m. on Saturday. Enrollment is limited to 30.

Computer algebra systems support a new approach to teaching classical applied mathematics, one that uses a "just-in-time" delivery of information and skills. This perspective is presented via examples taken from the list: Laplace transforms interactively, resonance by example, Fourier approximation to oscillators, Bessel and Legendre equations, fractionating columns, vector calculus, linear systems of ODEs, series solution of an ODE at an irregular singular point, the calculus of variations, and car-following models.

Participants interested in attending any of the MAA Minicourses should complete the MAA Minicourse Advance Registration Form found at the back of this issue and **send it directly to the MAA office** at the address given on the form so as to arrive prior to the November 12 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.

Please note that prepayment is required. Payment can be made by check, payable to MAA (Canadian checks must be marked "in U.S. funds") or Visa or MasterCard.

The registration fee for each of the MAA Minicourses is \$45 with exception of the computer minicourses (#3, 7, 13, & 17) which are \$65.

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 MAA Minicourse, this should be indicated by checking the appropriate box on the MAA Minicourse Advance Registration Form.** Then, if the minicourse is fully subscribed, a full refund can be made of the Joint Meetings advance registration fee. Otherwise, the Joint Meetings preregistration will be processed and then be subject to the 50% refund rule. Participants should take care when cancelling minicourse advance registration to make clear their intention as to their Joint Meetings preregistration,

since if no instruction is given, the Joint Meetings registration will also be cancelled. Advance Registration Forms for the Joint Meetings should be mailed to the Providence office prior to the deadline of November 12.

### Contributed Paper Sessions

*Actuarial mathematics education and research*, **James W. Daniel**, University of Texas, Austin; 2:15 p.m. on Thursday. Sponsored by Actuarial Faculty Forum.

*Applied geometry*, **Walter J. Meyer**, Adelphi University; 2:15 p.m. on Wednesday, and 8:00 a.m. on Thursday.

*The bridge to calculus*, **Marilyn E. Mays**, North Lake College, and **Linda H. Boyd**, DeKalb College; 8:00 a.m. and 1:00 p.m. on Saturday. Sponsored by the Committee on Two-Year Colleges.

*Environmental mathematics*, **B. A. Fusaro**, Salisbury State University, Salisbury; 8:00 a.m. on Wednesday and 2:15 p.m. on Thursday.

*Favorite nontraditional calculus assignments or projects*, **Duane D. Blumberg**, University of Southwestern Louisiana, Lafayette; 8:00 a.m. on Wednesday, and 2:15 p.m. on Thursday.

*Mathematics and music*, **Robert Lewand**, Goucher College; 8:00 a.m. on Friday, and 1:00 p.m. on Saturday.

*New methods for teaching elementary differential equations*, **T. Gilmer Proctor**, Clemson University, and **Robert Borrelli**, Harvey Mudd College; 8:00 a.m. on Friday, and 1:00 p.m. on Saturday.

*Reassessing discrete mathematics in the first two years*, **Susanna S. Epp**, DePaul University; 8:00 a.m. on Friday, and 1:00 p.m. Saturday.

*Research in undergraduate mathematics education*, **Warren Page**, NYC Technical College, CUNY; 1:00 p.m. on Friday, and 8:00 a.m. on Saturday. Sponsored by the AMS-MAA Committee on Research in Undergraduate Mathematics Education.

*Restructuring the mathematical preparation of teachers*, **Bettye M. Clark**, Clark Atlanta University; **Marjorie Enneking**, Portland State University; and **Philip D. Wagreich**, University of Illinois, Chicago; 8:00 a.m. on Friday, and 1:00 p.m. on Saturday.

*Restructuring teaching and learning in linear algebra*, **Donald R. LaTorre**, Clemson University; **Steven J. Leon** (for the ATLAST project), University of Massachusetts at Dartmouth; and **Charles R. Johnson** (for the LACSG), College of William and Mary; 2:15 p.m. on Wednesday, 7:30 p.m. on Thursday, and 1:00 p.m. on Friday.

*Teaching mathematics with a spreadsheet*, **Robert S. Smith**, Miami University, Oxford; 8:00 a.m. on Wednesday, and 2:15 p.m. on Thursday.

Details on submission procedures were published in the July/August issue of the *Notices* and the May/June issue of *Focus*. Authors should have supplied summaries of their talks to the organizers by September 3, 1993.

### Other MAA Sessions

**Changing the Culture—Making Your Department Inviting to Women:** This panel discussion is scheduled from 8:00 a.m. to 9:20 a.m. on Wednesday and is sponsored by the Committee on Participation of Women in Mathematics. The committee chair, **Carole B. Lacampagne**, U. S. Department of Education, will be the moderator.

**Revising the AP Calculus Syllabus:** This panel discussion, scheduled from 9:30 a.m. to 10:55 a.m. on Wednesday, will be organized and moderated by **Thomas W. Tucker**, Colgate University. The Advanced Placement Calculus Program is expecting to undertake a revision in the course syllabus in order to address various issues raised by the ongoing reform of calculus instruction taking place at the college level. This panel will discuss some of those issues and invites participation of the mathematical community in determining the future direction and shape of the AP Calculus Program. The panelists include **Wade Curry**, College Board; **Thomas P. Dick**, Oregon State University; **Deborah Hughes Hallett**, Harvard University; **Daniel Kennedy**, The Baylor School and chair of the AP Calculus Committee for College Board; and **Anita E. Solow**, Grinnell College; and the moderator.

**Reform in Engineering Curricula:** This panel discussion is scheduled from 9:30 a.m. to 10:55 a.m. on Wednesday and will be co-moderated by **Jane M. Day**, San Jose State University, and **Wade Ellis, Jr.** It is sponsored by the CUPM Subcommittee on Service Courses (Barbara A. Jur, chair). The panelists include **Donald W. Bushaw**, Washington State University; **Jeff Froyd**, Rose-Hulman Institute of Technology (department of electrical and computer engineering); and **Keith E. Schwingendorf**, Purdue University North Central, Westville.

**Interactive Mathematics Texts: Using Technology for Active Learning:** The Interactive Mathematics Text Project will hold an electronic poster session, organized by **Elizabeth J. Teles**, NSF and Montgomery College, in which selected developers of interactive texts will demonstrate work in progress. Participants will include **William J. Davis**, Ohio State University, and **David R. Hill**, Temple University. The session will be open Wednesday from 2:15 p.m. to 6:00 p.m. The sponsoring committee is CCIME, the Committee on Computers in Mathematics Education (L. Carl Leinbach, chair). This committee is also sponsoring a special fifty-minute presentation on *The promise of interactive texts*, given by **James E. White**, Institute for Advanced Technology, at 9:00 a.m. on Thursday.

**In the Year 2000: Who Will Your Students Be and What Will They Know about Mathematics?** This panel discussion, cosponsored by the American Mathematical Association of Two-Year Colleges (AMATYC), the MAA, and the National Council of Teachers of Mathematics (NCTM) is scheduled from 8:00 a.m. to 9:20 a.m. on Thursday. Organizers include **Susan L. Forman**, Mathematical Sciences Education Board; **Donald L. Kreider**, Dartmouth College; and **Marcia P. Sward**, MAA. Panelists include **Gail F. Burrill**, Whitnall High School, Hales Corner, Wisconsin; **Carolyn R. Mahoney**, California State University, San Mar-

cos; **Stephen Rodi**, Austin Community College; and **Zalman P. Usiskin**, University of Chicago. How will college students whose school mathematics programs were built on the NCTM Standards differ from today's students in the mathematical topics they have mastered, their problem-solving abilities, and their attitudes toward mathematics and its uses? How will collegiate faculty have to adapt curricula and teaching methods to accommodate these students? The panelists will explore these critical issues from their various perspectives.

**SUMMA Workshop:** This workshop on *Intervention projects for minority precollege students* is scheduled from 8:00 a.m. to 9:50 a.m. on Thursday. It will be organized and directed by **William A. Hawkins**, Director of SUMMA (Strengthening Underrepresented Minority Mathematics Achievement). The presenters will be **Joaquin Bustoz**, Arizona State University; **Roger Contreras**, University of Texas at Brownsville; and **Robert E. Megginson**, University of Michigan.

**Open Forum on Assessment:** An open forum on a draft of *Guidelines for an effective assessment program for the undergraduate major* will take place Thursday from 2:15 p.m. to 4:10 p.m. It is sponsored by the CUPM Subcommittee on Assessment (Bernard L. Madison, chair). A draft of these guidelines will be distributed to all departments during the fall of 1993. This draft was prepared by the Subcommittee on Assessment with assistance from representatives of MSEB and NCTM. The intent of the guidelines is to provide departments with critical guidance for the process of establishing a program of assessment of student learning in the undergraduate major in mathematics. Members of the subcommittee will be present to answer questions and receive advice for preparing the final report.

**Creating a Climate for Change—Math Leads the Way:** This panel discussion is scheduled from 2:15 p.m. to 4:10 p.m. on Thursday and will be organized and moderated by **Martha J. Seigel**, Towson State University. On October 2, 1993, The Math Connection, an MSEB-coordinated alliance of professional and educational organizations, and WQED in Pittsburgh (funded by the Annenberg Foundation) sponsored "Creating a Climate for Change . . . Math Leads the Way", a national teleconference. Representatives of the MAA and other Math Connection organizations, business, and parent leaders gathered at 150 local sites linked in the day-long interactive workshop. The program, which was designed to help communities get involved in education reform by using mathematics as a model, featured live and video presentations, on-site group work, panel discussions, and question-and-answer periods. The panelists, who were among local MAA representatives who participated, will share some video highlights and will discuss the issues raised and the strategies explored from the collegiate viewpoint. Panelists will be **Jerry L. Bona**, Pennsylvania State University, State College; **Marjorie Enneking**, Portland State University; **Joan Ferrini-Mundy**; **Genevieve M. Knight**, Coppin State College; **Kenneth C. Millett**, University of Santa Barbara; and the moderator.

**Research by Undergraduate Students:** This poster ses-

sion on Thursday from 2:15 p.m. to 4:10 p.m. is sponsored by the CUPM Subcommittee on Undergraduate Research in Mathematics, the Mathematical and Computer Science Division of the Council on Undergraduate Research (John Greever, chair) and the Committee on Student Chapters (Aparna W. Higgins, chair). Posters are invited which either describe mathematical research projects of individual undergraduate students or which describe the way in which undergraduate research is organized and encouraged at a given institution. Prospective exhibitors should contact **John Greever**, Harvey Mudd College.

**Calculus Reform Workshop Reunion:** This session is for participants of last summer's and this summer's workshops but is open to all. It will take place 7:00 p.m. to 8:15 p.m. on Thursday and is being organized by **Donald B. Small**, United States Military Academy.

**Humanistic Math Network Informal Gathering:** Interested people will meet informally from 7:15 p.m. to 8:15 p.m. on Thursday to discuss future plans, programs, and structure of the network.

**Writing in Mathematics Courses: a Maturing Discipline:** This panel discussion, scheduled from 8:00 a.m. to 9:20 a.m. on Friday, is organized by **Thomas W. Rishel**, Cornell University. The panelists will include **Thomas H. Barr**, Rhodes College; **John E. Meier**, Lafayette College; **Richard G. Montgomery**, Southern Oregon State College; and the organizer. Many people have now tried writing assignments in their mathematics courses, and they know they work. Panelists will discuss how these assignments are being used in various courses and schools.

**Issues in Implementing the MAA/AMATYC Guidelines:** This panel discussion is scheduled from 8:00 a.m. to 9:20 a.m. on Friday. The presenters will be **John D. Fulton**, University of Missouri, Rolla; **Philip A. DeMarois**, William Rainey Harper College; and four chairs of mathematics departments representing diverse institutions in higher education. To achieve the quality programs described in the guidelines, departments must begin to change traditional practice. This audience-interactive session will discuss some of the issues pertinent to implementing the *MAA/AMATYC Guidelines* in mathematics departments. The organizers are **James R. C. Leitzel**, University of Nebraska, and **Marilyn E. Mays**.

**Calculus Projects Maturing—a Chance to See What Is Emerging:** This poster session is scheduled Friday 8:00 a.m. to 10:55 a.m. and is sponsored by CRAFTY, the CUPM Subcommittee on Calculus Reform and the First Two Years (A. Wayne Roberts, chair) and the Calculus Reform Study Group (Marcelle Bessman, chair). Persons interested in participating should contact **A. Wayne Roberts**, Macalester College at [robertsw@macalstr.edu](mailto:robertsw@macalstr.edu) by December 1.

**Hearing on Precalculus Reform:** The hearing on the *Project on standards for two-year college and lower division mathematics below the level of calculus* is scheduled from 9:30 a.m. to 10:55 a.m. on Friday. It is being organized by **Marilyn E. Mays**, project director. This project is sponsored by AMATYC with representation from AMS, MAA, and NCTM and is funded by the NSF and Exxon Education

Foundation. The circulating draft of the standards was made available for review in October. Panelists will be **Linda H. Boyd**, DeKalb College; **Dale E. Ewen**, Parkland College; **Harvey B. Keynes**; **James R. C. Leitzel**; and **Karen Sharp**, Mott Community College.

**Aspects of Humanistic Mathematics:** This panel discussion will be held from 9:30 a.m. to 10:55 a.m. on Friday and will be organized and moderated by **Alvin M. White**, Harvey Mudd College. Panelists will be **Jack V. Wales**, The Thacher School in California; **Joan Countryman**, Lincoln School in Providence; and **Tom Tymoczko**, Smith College. They will focus on mathematics and its applications, how students perceive mathematics, and value judgments in mathematics.

**Laboratory Approaches in Undergraduate Mathematics:** This poster session is scheduled on Friday from 1:00 p.m. to 6:00 p.m. It is organized by **Arnold M. Ostebee**, St. Olaf College, as part of the MAA project, Priming the Pump for Curricular Reform, funded by the NSF. Laboratory experiences in using appropriate technology are playing an increasing role in the teaching and learning of undergraduate mathematics. This poster session highlights some of the innovative approaches developed by mathematical sciences faculty for use in their programs. The projects discussed have been supported in part by the NSF through its Division of Undergraduate Education's initiative in Instrumentation and Laboratory Improvement/Leadership Projects in Laboratory Development.

**MAA Teaching Awards Presentations:** The three winners of the second series of MAA Awards for Distinguished College or University Teaching of Mathematics are **Paul R. Halmos**, Santa Clara University; **Justin J. Price**, Purdue University; and **Alan C. Tucker**, SUNY at Stony Brook. The awards will be presented at the Joint Prize Session on Thursday afternoon. Each winner will make a presentation on "the secrets of their success" at a special session on Friday from 3:20 p.m. to 5:00 p.m.

**NSF Calculus Institute Using CAS:** This session, scheduled from 5:30 p.m. to 6:30 p.m. on Friday, will report on the institute held at Northern Kentucky University during the summer of 1993. Emphasis will be on classroom demonstrations and lab projects developed by the participants. The software packages used are *Derive* and *Converge*. The presentations will be made by **Darrell H. Abney**, Maysville Community College, and **Larry Gilligan**, University of Cincinnati.

**Poetry Reading:** This is scheduled from 6:30 p.m. to 7:20 p.m. on Friday and is open to all interested persons—readers and nonreaders. Bring mathematical poems of your own or verse by other poets. If possible bring copies (50+) to give to interested members of the audience. No advance registration is required, but the organizers, **JoAnne S. Grown** of Bloomsburg University, and **Alvin M. White** of Harvey Mudd College, would be pleased to hear from you in advance.

**Calculus Reform Study Group:** This open meeting will be held from 7:00 p.m. to 8:30 p.m. on Friday. The organizer is **Marcelle Bessman**, Frostburg State University, who is chair of the study group.

**Micro-inequities Skits—the Second Generation:** On

Friday from 8:15 p.m. to 10:00 p.m. the Committee on the Participation of Women is presenting its eighth program of skits about the incidents reported by mathematicians that reveal the current relationship between the sexes within our community. These all-new skits will each offer two endings: what actually happened and how we wish the incident had been resolved.

**Assessing Calculus Reform Efforts—a Report to the Community:** This sixty-minute panel session will take place at 1:00 p.m. on Saturday. With support from the NSF the 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 will report the findings. The organizer and moderator will be **James R. C. Leitzel**. The panelists will be **John A. Dossey**, Illinois State University; **Judy Franz**, University of Alabama-Huntsville; **Alan C. Tucker**; and the moderator.

**What Happens after Calculus Reform?:** This panel discussion, organized by **Sheldon P. Gordon**, Suffolk Community College, is scheduled from 2:10 p.m. to 4:00 p.m. on Saturday. Participants will include **Deborah Hughes Hallett**; **Arnold M. Ostebee**, St. Olaf College; **Anthony L. Peressini**, University of Illinois; **David A. Smith**, Duke University; **Alan C. Tucker**; and the organizer. Now that many of the calculus reform projects are having significant impact across the country, it is time to turn attention to other aspects of the mathematical curriculum. In particular, the calculus reform movement has direct implications for multivariate calculus, differential equations, possibly linear algebra, and certainly the precalculus preparation of students. Questions addressed will include how the calculus reform movement relates to these other offerings and how we can apply what we've learned from this movement.

**Curriculum Projects in Undergraduate Mathematics:** This special session is scheduled from 2:15 p.m. to 6:00 p.m. on Saturday and is organized by **James R. C. Leitzel** as part of the MAA project, Priming the Pump for Curricular Reform, funded by the NSF. In addition to projects directed toward changes in the teaching and learning of calculus, there are projects addressing change in other areas of the undergraduate mathematics curriculum. This session highlights some of these projects that were recently funded through the NSF's program in Undergraduate Course and Curriculum Development.

**Quantitative Literacy Open Meeting:** Saturday from 2:45 p.m. to 4:00 p.m. individuals will have an opportunity to discuss informally with members of the CUPM Subcommittee on Quantitative Literacy (**Linda R. Sons**, chair) their questions, ideas, and problems regarding a quantitative literacy program at their institution. The committee is prepared to explain its views on what quantitative literacy is and why and how it should be fostered in colleges and universities.

**Mathematical Life Outside Academia—Input from the Real World:** This panel discussion, scheduled from 3:15 p.m.



to 4:45 p.m. on Saturday, is organized by **Burton H. Colvin**, National Institute of Standards and Technology, and **Robert J. Thompson**, Sandia, and sponsored by the Committee on Mathematicians Outside Academia (Patrick D. McCray, chair). The focus of the panel will be on what life is really like for mathematicians outside academia, the situations which mathematicians face, the ways in which these situations can be addressed, and what their experiences are as products of our mathematical educational system. What mathematical skills and habits of mind are really used, how are they actually being used, how much, how often? Interesting (frustrating?) topics such as maintaining currency, publishing, research, and using mathematics will be discussed. The moderator will be **S. Brent Morris**.

#### Other MAA Events

**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:** The MAA Business Meeting is scheduled from 12:15 p.m. to 12:45 p.m. on Thursday. This meeting is open to all members of the Association.

**Board of Governors:** The MAA Board of Governors will meet from 8:30 a.m. to 4:00 p.m. on Tuesday. This meeting is open to all members of the Association.

**Section Officers:** There will be a Section Officers meeting from 4:30 p.m. to 6:30 p.m. on Wednesday.

#### Student Activities

**MAA Student Chapter Hospitality/Information Center:** The MAA Committee on Student Chapters is sponsoring a hospitality/information center in the CCC which will be open during the same hours the Joint Meetings Registration Desk is open, from Wednesday morning until 3:00 p.m. on Saturday. The center will be a gathering place for all students who are attending the Joint Meetings.

**Student Lecture:** This year's lecture by **S. Brent Morris** is titled *Magic tricks, card shuffling, and computer memories*. This lecture is scheduled for 7:30 p.m. on Friday and is sponsored by the Committee on Student Chapters. The talk will be followed by a "make-your-own sundae" party.

**Calculated Deceptions:** This student workshop is scheduled from 1:00 p.m. to 3:00 p.m. on Saturday. The organizer will be **S. Brent Morris**. Several magic tricks based on mathematical principles will be examined. After studying the magic, the mathematics will be generalized, in some cases leading to other tricks. Attendees will gain a better understanding of practical applications of mathematics (and should be able to amaze their friends).

**Continental Breakfast for Student Chapter Advisors and Section Coordinators:** This breakfast is scheduled from 7:00 a.m. to 8:00 a.m. on Thursday in the Student Hospitality/Information Center; the contact person is **Aparna W. Higgins**, University of Dayton.

**The Second Annual MAA Student Chapters Special Paper Session:** This session is scheduled on Thursday from

8:00 a.m. to 10:55 a.m. and will serve as a forum for the exchange of ideas among advisors to individual chapters and section coordinators. These fifteen-minute talks, which will focus on one or several activities implemented by a campus chapter or by a section, is sponsored by the Committee on Student Chapters and organized by **Karen J. Schroeder**, Bentley College.

#### Activities of Other Organizations

The **Association for Women in Mathematics (AWM)** is pleased to present its fifteenth annual **Emmy Noether Lecture**. This year's lecturer will be **Lesley M. Sibner**, Polytechnic University, who will speak on *Analysis in gauge theory* at 9:00 a.m. on Thursday. (A dinner in her honor is described in the *Social Events* section of this announcement.)

**AWM Panel Discussion:** This will take place at 3:20 p.m. on Wednesday and will be followed by the **Prize Session and the Business Meeting** at 4:20 p.m.

**AWM Workshop:** The AWM will conduct a workshop for women graduate students and postdoctorate fellows in mathematics on Tuesday from 9:00 a.m. to 5:00 p.m. similar to the ones held at other Joint Meetings. There will be funding for travel, subsistence, and registration fees for ten women graduate students and ten women postdocs to attend the workshop and the Joint Meetings. (Funding is provided by the National Science Foundation and the Office of Naval Research.) The workshop will provide opportunities to present and discuss 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 at a luncheon and a dinner.

All mathematicians (female and male) are invited to attend the entire program even though only twenty women are funded. Departments are urged to help graduate students and postdoctoral fellows obtain some institutional support to attend the workshop and the Joint Meetings that follow.

All applications must be postmarked by **October 8, 1993**, and sent to the Association for Women in Mathematics, 4114 Computer and Space Sciences Building, University of Maryland, College Park, MD 20742-2461. For application procedures or additional information contact Virginia Reinhart at (301) 405-7852 or e-mail: awm@math.umd.edu.

There will be an **AWM Dinner** following the workshop. Please see details in the *Social Events* section.

An **Open Reception** is planned for 9:30 p.m. on Wednesday. See the *Social Events* section for details.

A public policy address cosponsored by the **Joint Policy Board for Mathematics (JPBM)**, the AMS Committee on Science Policy, the MAA Science Policy Committee, and the SIAM Science Policy Committee is scheduled on Thursday evening at 7:00 p.m. It is anticipated that the speaker will be the new director of the National Science Foundation.

The **JPBM Committee on Professional Recognition and Rewards** (Calvin C. Moore, chair) will present a panel discussion on Wednesday from 9:00 a.m. to 10:00 a.m. Highlights of their final report on the findings resulting from



their study of the rewards system in the mathematical sciences, together with their recommendations, will be presented. The committee intends this meeting to provide an opportunity for dialog with the mathematical community and questions from the floor will be encouraged.

The **National Association of Mathematicians (NAM)** will present the William W. S. Claytor Lecture at 9:00 a.m. on Saturday. **James C. Turner, Jr.**, Ohio State University and Central State University, will speak on *A novel approach to turbulent modeling*.

**Etta Z. Falconer**, Spelman College, will give the Cox-Talbot Address titled *Challenges and opportunities for minorities in science and mathematics* at the NAM Banquet Friday evening. Please see more detailed information about the banquet in the *Social Events* section of this announcement.

At 3:15 p.m. on Friday NAM will have a session of *Presentations by recent doctoral recipients*, moderated by **John W. Alexander, Jr.**, University of the District of Columbia.

A panel discussion on *NAM's undergraduate MATHFest: one approach to the pipeline issue* will take place from 10:00 a.m. to 10:55 a.m. on Saturday. The moderator is **Johnny L. Houston**, Elizabeth City State University.

The NAM Business Meeting will take place from 2:15 p.m. to 3:00 p.m. on Saturday.

The **National Science Foundation (NSF)** is sponsoring an address from 5:05 p.m. to 5:55 p.m. on Wednesday.

The NSF invites participants at the Joint Mathematics Meetings to meet informally with staff members from noon to 1:00 p.m. daily, Wednesday through Saturday.

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.

The **Rocky Mountain Mathematics Consortium (RMMC)** Board of Directors will meet on Friday from 2:15 p.m. to 4:10 p.m.

### 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:** 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. The book sales will be open the same days and hours as the exhibits.



A special publications exhibit in the AMS booth will showcase books on the history of mathematics.

**Exhibits:** The book, educational media, and software exhibits will be open 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. All participants are encouraged to visit the exhibits during the meeting. **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.**



There will be a special display of photographs and mementos of AMS meetings past.

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

**Mathematical Sciences Employment Register:** Those wishing to participate in the Cincinnati 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 30**. 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.

**AWM Workshop Dinner:** The Association for Women in Mathematics will host a dinner after the conclusion of their workshop on Tuesday. There will be a cash bar reception at 5:15 p.m. followed by dinner at 6:15 p.m. All participants are invited to attend the dinner whether or not they attended the workshop. The menu includes mixed greens, julienne of seasonal vegetables, and tangy black peppercorn and mustard dressing; sliced london broil; chef's choice of vegetables and potato, rice, pasta, or sauteed barley; rolls and butter; apple strudel with vanilla sauce; and coffee and tea. Tickets are \$27.50 each including taxes and gratuity.


**AWM Reception:** There is an open reception on Wednesday evening at 9:30 p.m. This has been a popular, well-attended event in the past, and musical entertainment is anticipated.

All participants are invited to a **dinner to honor AWM's Noether Lecturer**, Leslie M. Sibner, 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 7:00 p.m. and includes a salad with Boston bibb lettuce, romaine, artichoke hearts, hearts of palm, tomato, and lemon with mustard vinaigrette; broiled salmon with tomato fennel sauce; fresh seasonal vegetables; parsnips new potatoes; rolls and butter; and coffee and tea. Dessert will be flourless chocolate torte with vanilla sauce. Tickets are \$36 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 menu includes mixed greens with tomato, cucumber, julienne of carrot, and gourmet dressing; roasted breast of chicken with hazelnut cream sauce; sweet potatoes dauphinois; fresh seasonal vegetables; dessert; rolls and butter; and coffee and tea. Tickets are \$25 including tax and gratuity.

 **AMS Banquet:** As a fitting culmination to the day's 100th Annual Meeting celebration 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 receive a special award. The banquet will be held on Saturday with a cash bar reception at 6:15 p.m. and dinner at 7:15 p.m. Special door prizes will be four travel gift certificates ranging in value from \$250 to \$1,000. Each attendee will receive a memento of the occasion.

The menu includes a salad of Boston bibb lettuce, radicchio, walnuts, sliced mushrooms with Balsamic vinaigrette dressing; boneless breast of chicken with tarragon mushroom sauce; mixed rice with chutney; fresh seasonal vegetables; strawberries with creme anglaise; rolls and butter; and coffee and tea. Tickets are \$25 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 the ordinary deadline of November 12 may use the housing services offered by the Mathematics Meetings Service Bureau (MMSB) and may elect to receive their programs, badges, and tickets for social events (if purchased) through the mail before the meeting.

### Joint Mathematics Meetings

Member of AMS, Canadian Mathematical Society, MAA	\$125
Emeritus Member of AMS, MAA;	
Students; Unemployed; Librarians;	
High School Teachers	35
Nonmember	194
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	70

### MAA Minicourses

Minicourses #1, 2, 4, 5, 6, 8, 9, 10, 11, 12, 14, 15, 16	\$ 45
Minicourses #3, 7, 13, 17	65

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 12 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.

All **full-time students** currently working toward a degree or diploma qualify for the student registration fees regardless of income. 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 make the appropriate indication on the Advance Registration/Housing Form.

The **librarian** registration category refers to any librarian who is not a professional mathematician.

The **unemployed** status refers to 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.

Persons who qualify for **emeritus** membership in either the Society or the Association may register at the emeritus

member rate. 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.

**Nonmembers** who register in advance or register at the meeting and pay the nonmember fee will receive mailings from AMS and MAA after the meeting is over containing information about a special membership offer.

**Advance Registration Deadlines:** There are three separate advance registration deadlines, each with its own advantages and benefits.

<b>EARLY</b> advance registration (housing and room lottery)	October 29
<b>ORDINARY</b> advance registration (housing but no lottery)	November 12
<b>FINAL</b> advance registration (no housing, tickets, or inclusion in the <i>Winter Lists</i> for the Employment Register)	December 13

**Early Advance Registration:** Those who register by the EARLY deadline of October 29 will be included in a drawing to select randomly winners of complimentary hotel rooms in Cincinnati. 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 San Antonio in the hotel pages.)

**Ordinary Advance Registration:** Those who register after October 29 and by the ORDINARY deadline of November 12 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 12 and by the FINAL deadline of December 13 must pick up their badges, programs, and tickets for social events (if purchased) 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 13 deadline is firm and any forms received after that date will be returned and full refunds issued.**

**Electronic Advance Registration:** Those wishing to register in advance through this method should send a message to [meet@math.ams.org](mailto:meet@math.ams.org) requesting this service. 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. This form and instructions on how to use it also may be found on e-MATH.

All EARLY and ORDINARY advance registrants will receive formal acknowledgments prior to the meetings. FINAL advance registrants will receive a letter from the MMSB

(including receipt of payment) prior to the meetings.

Both EARLY and ORDINARY advance registrants 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 \$2 replacement fee will be charged for programs and badges that are mailed but not taken to Cincinnati.

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.)

### 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 (Kenneth A. Ross, Department of Mathematics, University of Oregon, Eugene, OR 97403). These requests should be received **by November 9, 1993.**

All other speakers requiring additional equipment should contact the audio-visual coordinator for the meetings at the AMS office in Providence at 401-455-4140, or electronic mail [wsd@math.ams.org](mailto: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 CCC. 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.

## How to Obtain Hotel Accommodations

The following participants received complimentary hotel rooms during the San Antonio 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 Cincinnati room lottery are urged to register by the **EARLY** deadline of October 29.

**San Antonio Room Lottery Winners:** HOLIDAY INN - Edward Merks  
Rogers Newman

TRAVELODGE - Peter Williams  
Yuri Letushkin

CROCKETT - Robert McKeavey  
Michael Neumann  
Tom Brown  
Marta Pecuch-Herrero

HILTON - Miao Nagayama  
R. Lee VandeWetering  
Roselyn Lee  
Bernard Sohmer

MENDER - Daniel Bettendorf  
Theodore Hatcher  
Hung The Dinh  
Gail Earles

EMILY MORGAN - Daniel Flath  
Ollie Nanyes  
Michael Hutchings  
Arthur Guetter

HYATT - Conduff Childress

The AMS-MAA Joint Meetings Committee always endeavors to obtain the lowest possible 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 and complexity over the years, it has been necessary to find larger facilities with many more session rooms. Unfortunately, the cost of these facilities is higher than can be covered by the registration fees, and 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 rental cost of the Cincinnati Convention Center (CCC). Rates quoted 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. Reservations must be made through the MMSB to receive the convention rates listed below. The MMSB encourages participants to feel free to call them at 401-455-4143 or 401-455-4145 for more detailed descriptions of the hotels, if necessary.

**Rates:**

- hotels are listed below by descending order of regular single room rates
- subject to a 10% sales/occupancy tax
- parking rates are per day rates
- only certified students or unemployed mathematicians qualify for listed student rates

**Deadlines:**

- reservations thru MMSB - November 12
- hotel will not accept direct reservations
- changes/cancellations thru MMSB - December 10
- changes/cancellations thru hotels - after December 22
- reservations thru hotels - after December 22 (convention rates based on availability only)

**Guarantee Requirements:**

- \$50 (or more) by check
- credit card - VISA, MC, AE

**Room Payments:**

- all major credit cards
- personal checks with personal id and/or credit card backup

**Special Services:**

- all hotels in or working towards being in compliance with the Americans with Disabilities Act (ADA)
- special needs should be clearly indicated on ARH Form

### Hotel Info:

- limited nonsmoking rooms available
- checkin time - 3p.m. (all hotels)
- checkout time - 1p.m. (Terrace Hilton, Westin)
- 11a.m. (Clarian)
- noon (rest of hotels)
- hotels with some rooms with windows that open - Terrace Hilton, Quality, and the Holiday Inns

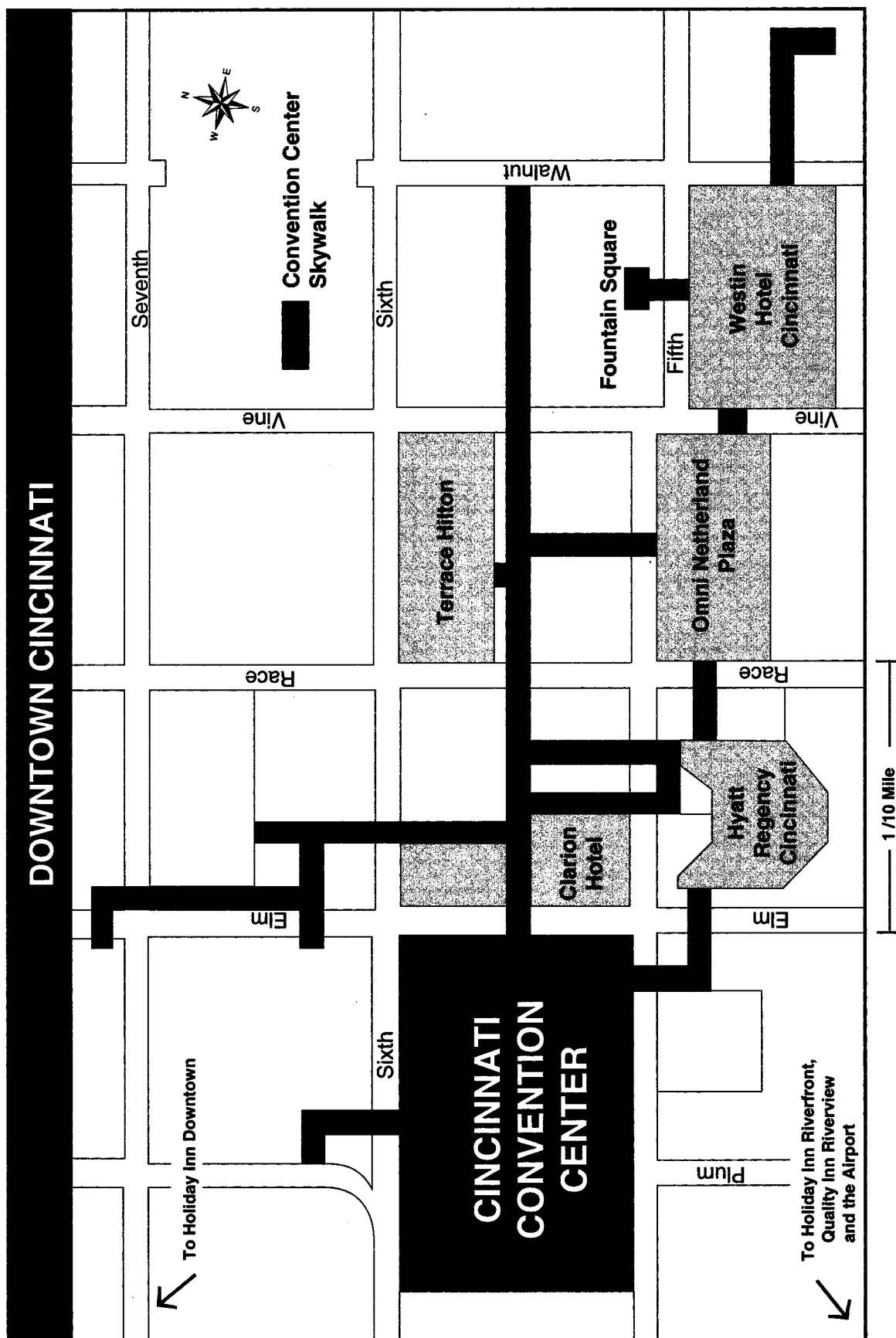
Hotel Name Distance from CCC	Location	Description	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites (starting rates)
Hyatt Regency Cincinnati (Headquarters) .06 miles	151 West Fifth Street Cincinnati, OH 45202 513-579-1234	Restaurants, Lounge, Indoor Pool Parking \$12.50 valet (In/Out), Health Club Children 18 yrs. and younger free	\$ 83	\$ 83	\$ 83	\$ 93	\$ 113	\$ 93	\$ 113	\$ 360+
	REGULAR									
	STUDENT		73	73	73	73	93	73	93	N/A
The Westin .20 miles	At Fountain Square Cincinnati, OH 45202 513-621-7700	Restaurants, Lounge, Indoor Pool, Fitness Ctr Parking \$8 self (In/Out), \$12.95 valet Children 18 yrs. and younger free	82	82	82	82	97	82	97	135+
	REGULAR									
	STUDENT		70	70	70	70	85	70	85	N/A

(CONTINUED ON NEXT PAGE)

## How to Obtain Hotel Accommodations (continued)

Hotel Name Distance from CCC	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)
Terrace Hilton .15 miles	15 West Sixth Street Cincinnati, OH 45202 513-381-4000	Restaurant, Lounge, Health Club Parking \$11 self (In/Out) Children 18 yrs. and younger free								
	REGULAR		\$ 80	\$ 80	\$ 80	\$ 90	\$ 110	\$ 90	\$ 110	\$ 140
Clarion .06 miles (Directly Connected to Center)	141 West Sixth Street Cincinnati, OH 45202 513-352-2100	Restaurants, Lounge, Heated Outdoor Pool Parking \$11 valet (In/Out), Health Club Children 17 yrs. and younger free								
	STUDENT		70	70	70	70	90	70	90	N/A
Omni Netherland Plaza .15 miles	35 West Fifth Street Cincinnati, OH 45202 513-421-9100	Restaurants, Lounge, Indoor Lap Pool Parking \$12.50 valet (In/Out), Health Club Children 18 yrs. and younger free								
	REGULAR		79	79	79	89	109	89	109	176+
Holiday Inn Queensgate* (Downtown) 1 mile	800 West Eighth Street Cincinnati, OH 45203 513-241-8660	Restaurant, Lounge, Outdoor Pool Free Parking Children under 18 yrs. free								
	STUDENT		49	49	83	93	N/A	103	N/A	205+
Quality Hotel Riverfront* 1 mile	666 Fifth Street Covington, KY 41011 606-491-1200	Restaurants, Lounge, Indoor Pool Free Parking, Health Club Children under 17 yrs. free								
	REGULAR		59	59	59	64	64	69	69	175+
Holiday Inn Riverfront* 1 mile	600 West Third Street Covington, KY 41011 606-291-4300	Restaurant, Lounge, Outdoor Pool Free Parking, Health Club (off premise) Children under 18 yrs. free								
	STUDENT		45	45	45	45	55	45	55	N/A
Quality Hotel Riverfront* 1 mile	600 West Third Street Covington, KY 41011 606-291-4300	Restaurant, Lounge, Outdoor Pool Free Parking, Health Club (off premise) Children under 18 yrs. free								
	REGULAR		51	51	51	51	61	51	61	N/A
Quality Hotel Riverfront* 1 mile	600 West Third Street Covington, KY 41011 606-291-4300	Restaurant, Lounge, Outdoor Pool Free Parking, Health Club (off premise) Children under 18 yrs. free								
	STUDENT		41	41	41	41	51	41	51	N/A

\* The Holiday Inn Queensgate, Quality Hotel Riverfront, and Holiday Inn Riverfront are not within walking distance. Complimentary shuttle service will be provided to and from these properties.



All downtown hotels are located within a five minute walk of the Cincinnati Convention Center (CCC). All other hotels are located approximately one mile from the CCC and are not within walking distance. Complimentary shuttle service will be provided to and from these properties.

**Information Distribution:** A table is set up in the registration area for dissemination of general information of possible interest to the members.

A second table is set up in the exhibit area 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.

**Mail:** All mail and telegrams for persons attending the Joint Meetings should be addressed as follows: Name of Participant, Joint Mathematics Meetings, Cincinnati Convention Center, 525 Elm St., Cincinnati, OH 45202. Mail and telegrams so addressed will be posted on the Math Meetings Message Board. U.S. mail not picked up will be forwarded after the meetings to the mailing address given on the participant's registration record.

**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.

Signs of moderate size may be displayed at the table but must not represent that the case of the individual in question is backed by the Committee on Human Rights unless it has, in fact, so voted. Volunteers may be present at the table to provide information on individual cases, but notice must be sent at least seven days in advance of the meetings to the director of meetings in the Providence office, telephone: 401-455-4137. Since space is limited it may also be necessary to limit the number of volunteers present at the table at any one time. The Committee on Human Rights may delegate a person to be present at the table at any or all times, taking precedence over other volunteers.

Any material which is not a petition (e.g., advertisements, résumés) will be removed by the staff. **At the end of registration on Saturday any material on the table will be discarded, so individuals placing petitions on the table should be sure to remove them prior to the close of registration.**

**Telephone Messages:** These may be left at the Meetings Registration Desk from from January 11 through 15 during the hours that the Desk is open and will be posted on the Math Meetings Message Board. Once the Registration Desk has closed for the day, there is no mechanism for contacting participants other than calling them directly at their hotel. The telephone number at the Desk is 513-784-6011.

**Travel:** In January Cincinnati is on Eastern Standard Time. The Cincinnati/Northern Kentucky International Airport is lo-

cated 12 miles (15 minutes) from downtown Cincinnati, across the Ohio River in northern Kentucky. Jetport Express shuttle vans depart the airport for downtown every half hour between 6:00 a.m. and 10:00 p.m. The cost is \$10 one way and \$13 round trip if you tell them you are attending a convention center event. Taxi fare from the airport to downtown is approximately \$21.

DELTA and USAIR have been selected as the official airlines for this meeting. The following benefits are available exclusively to mathematicians and their families attending the meetings:

On DELTA 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, is available. Seats are limited. Call 1-800-241-6760 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.

On USAIR you may receive 10% off any published domestic fare with a seven-day advance purchase. Call USAir's Meetings and Convention Reservation Office at 1-800-334-8644 between 8:00 a.m. and 9:00 p.m. EST or call any licensed travel agent and refer to gold file **#16950015**.

For Amtrak information call 1-800-872-7245.

**Weather:** January weather in Cincinnati is generally cool to cold. Normal daily maximum and minimum temperatures are 37°F (3°C) and 20°F (-7°C). Average precipitation for January is 2.5" which includes an average of 9" of snow in January.

#### **AMS-MAA Joint Program Committee**

Richard A. Askey, Thomas F. Banchoff, H. W. Lenstra (chair), and Peter M. Winkler.

#### **AMS Program Committee for National Meetings**

Hermann Flaschka, Robert M. Fossum (*ex officio*), Jerrold E. Marsden, Dusa McDuff, H. W. Lenstra, Nancy K. Stanton (chair), and Mary F. Wheeler.

#### **MAA Program Committee for the Cincinnati Meeting**

Sheldon Axler, David W. Ballew (*ex officio*), Francis W. Carroll, Ed Dubinsky, Joseph Ferrer, Aparna W. Higgins, Albert C. Lewis, Hugh Montgomery, Robert Osserman, Bruce P. Palka, Janet B. Roll, and Robert S. Smith (chair).

#### **Local Arrangements Committee**

Franklin W. Brieser, Joseph K. Casey, Milton D. Cox, Robert Daverman (*ex officio*), Edward P. Merkes, William H. Jaco (*ex officio*), Melinda Michael, Kenneth A. Ross (*ex officio*), David Styer (chair), Marcia Sward (*ex officio*), and Janice B. Walker.



New  
Series

## FIELDS INSTITUTE COMMUNICATIONS

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## Dynamics and Control of Mechanical Systems The Falling Cat and Related Problems

Michael J. Enos, Editor

Volume 1

This book contains a collection of papers presented at the Fields Institute workshop, "The Falling Cat and Related Problems," held in March 1992. The theme of the workshop was the application of methods from geometric mechanics and mathematical control theory to problems in the dynamics and control of freely rotating systems of coupled rigid bodies and related nonholonomic mechanical systems. This book will prove useful in providing insight into this new and exciting area of research.

1991 *Mathematics Subject Classification*: 70, 58, 93, 49

ISBN 0-8218-9200-2, 280 pages (hardcover), July 1993

Individual member \$52, List price \$87, Institutional member \$70

To order, please specify FIC/1NA

## Control of Flexible Structures

K. A. Morris, Editor

Volume 2

This volume contains papers presented at the workshop "Problems in Sensing, Identification, and Control of Flexible Structures". Topics range from theoretical research on the well-posedness of systems to experimental implementations of various controllers. A number of controller design techniques are discussed and compared, and there are several papers on modelling the complex dynamics of flexible structures. This book is a useful resource to control theorists, engineers, and mathematicians interested in this important field of research.

1991 *Mathematics Subject Classification*: 93, 70

ISBN 0-8218-9201-0, 243 pages (hardcover), July 1993

Individual member \$49, List price \$82, Institutional member \$66

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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.

# Timetable

(Eastern Standard Time)

## AMS SHORT COURSE SERIES

*COMPLEX DYNAMICS: THE MATHEMATICS BEHIND THE MANDELBROT AND JULIA SETS*

**Monday,  
January 10**

### MORNING

11:00 a.m.–5:00 p.m.

SHORT COURSE REGISTRATION

### AFTERNOON

1:00 p.m.–1:50 p.m.

SHORT COURSE LECTURE #1  
*Overview of quadratic dynamics*  
**Robert L. Devaney**

2:00 p.m.–3:15 p.m.

SHORT COURSE LECTURE #2  
*Julia sets*  
**Linda Keen**

3:45 p.m.–5:00 p.m.

SHORT COURSE LECTURE #3  
*The parabolic implosion*  
**Adrien Douady**

**Tuesday,  
January 11**

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

### MORNING

8:30 a.m.–4:00 p.m.

BOARD OF GOVERNORS MEETING

9:00 a.m.–10:15 a.m.

SHORT COURSE LECTURE #4  
*The spider algorithm*  
**John H. Hubbard**

9:00 a.m.–5:00 p.m.

ASSOCIATION FOR WOMEN  
IN MATHEMATICS (AWM)  
WORKSHOP

10:45 a.m.–noon

SHORT COURSE LECTURE #5  
*The dynamics of complex cubic polynomials with disconnected Julia sets*  
**Bodil Branner**

### AFTERNOON

1:00 p.m.–10:00 p.m.

COUNCIL MEETING

2:00 p.m.–3:15 p.m.

SHORT COURSE LECTURE #6  
*The dynamics of Newton's method*  
**Paul R. Blanchard**

3:00 p.m.–7:00 p.m.

REGISTRATION FOR JOINT MEETINGS

# Timetable

**Tuesday,  
January 11 (cont'd)**

**American  
Mathematical Society**

**Mathematical  
Association of America**

**Other  
Organizations**

**AFTERNOON (cont'd)**

3:45 p.m.–5:00 p.m.

**SHORT COURSE LECTURE #7**  
*Dynamics of entire functions*  
**Robert L. Devaney**

**EVENING**

5:15 p.m.–8:00 p.m.

**AWM WORKSHOP DINNER**

6:00 p.m.–9:00 p.m.

**MATHCHATS AND GRADUATE STUDENT  
RECEPTION**

**Wednesday,  
January 12  
MORNING**

7:30 a.m.–4:00 p.m.

**EMPLOYMENT REGISTER REGISTRATION**

9:00 a.m.–9:30 a.m.

**EMPLOYMENT REGISTER ORIENTATION SESSION**

7:30 a.m.–4:00 p.m.

**REGISTRATION FOR JOINT MEETINGS**

8:00 a.m.–10:55 p.m.

**AMS-MAA SPECIAL SESSION**  
*Mathematics and education reform, I*

8:00 a.m.–10:55 p.m.

**SPECIAL SESSIONS**  
*Algebraic topology and  
dynamical systems, I*  
  
*Singular boundary value  
problems, I*

**CONTRIBUTED PAPER SESSIONS**  
*Environmental mathematics, I*  
  
*Favorite nontraditional calculus as-  
signments or projects, I*

# Timetable

Wednesday,  
January 12 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

MORNING (cont'd)

8:00 a.m.–10:55 a.m.

*Operator theory, nonself adjoint  
operator algebras and control  
theory, I*

*Representation theory and har-  
monic analysis, I*

*Geometric applications of opera-  
tor algebras and index theory, I*

*Quadratic forms and division  
algebras, I*

*Advances in function theoretic  
methods, I*

*Wavelets and their applications, I*

SESSIONS FOR  
CONTRIBUTED PAPERS

*Teaching mathematics with a  
spreadsheet, I*

8:00 a.m.–10:00 a.m.

MINICOURSE #1 (Part A)  
*Organizing an undergraduate  
research program*

MINICOURSE #2 (Part A)  
*Inverse problems in the  
undergraduate classroom*

MINICOURSE #3 (Part A)  
*The Joy of Mathematica: a point-and-  
click way to use and learn  
Mathematica*

MINICOURSE #4 (PART A)  
*How to make effective use of inex-  
pensive pocket computers to develop  
the concepts and techniques of  
calculus*

COMMITTEE ON PARTICIPATION  
OF WOMEN IN MATHEMATICS  
PANEL DISCUSSION  
*Changing the culture—making your  
department inviting to women*

8:00 a.m.–9:20 a.m.

9:00 a.m.–10:00 a.m.

JOINT POLICY BOARD ON MATHEMATICS (JPBM)  
COMMITTEE ON PROFESSIONAL RECOGNITION  
AND REWARDS PANEL DISCUSSION

9:30 a.m.–10:55 a.m.

PANEL DISCUSSION  
*Revising the AP calculus syllabus*

CUPM SUBCOMMITTEE ON  
SERVICE COURSES  
PANEL DISCUSSION  
*Reform in engineering curricula*

# Timetable

**Wednesday,  
January 12 (cont'd)**

**American  
Mathematical Society**

**Mathematical  
Association of America**

**Other  
Organizations**

**MORNING (cont'd)**

10:05 a.m.–10:55 a.m.

**INVITED ADDRESS**  
*Particle configurations, instantons,  
and holomorphic maps*  
**Jacques C. Hurtubise**

11:10 a.m.–noon

**AMS-MAA INVITED ADDRESS**  
*A tale of two groups*  
**Georgia M. Benkart**

**AFTERNOON**

noon–1:00 p.m.

**NATIONAL SCIENCE FOUNDATION**  
Informal Discussion Group

1:00 p.m.–2:00 p.m.

**COLLOQUIUM LECTURE I**  
*Harmonic analysis and nonlinear  
evolution equations*  
**Jean Bourgain**

1:00 p.m.–5:00 p.m.

**BOOK SALE**

**BOOK SALE**

**EXHIBITS**

2:00 p.m.–3:15 p.m.

**AMS-MAA-SIAM COMMITTEE ON EMPLOYMENT OPPORTUNITIES**  
**PANEL DISCUSSION**  
*Effective job seeking in today's market*

2:15 p.m.–3:05 p.m.

**INVITED ADDRESS**  
*Mathematics and the ubiquitous  
spreadsheet: visualization,  
conceptualizations, and applications*  
**Deane Arganbright**

2:15 p.m.–6:00 p.m.

**AMS-MAA SPECIAL SESSION**  
*Mathematics and education reform, II*

2:15 p.m.–4:00 p.m.

**COMMITTEE ON SCIENCE  
POLICY PANEL DISCUSSION**  
*The place of mathematics in national  
science and technology goals*

# Timetable

Wednesday,  
January 12 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

AFTERNOON (cont'd)

2:15 p.m. – 6:00 p.m.

## SPECIAL SESSIONS

*Algebraic topology and  
dynamical systems, II*

*Singular boundary value  
problems, II*

*Operator theory, nonself adjoint  
operator algebras and control  
theory, II*

*Representation theory and har-  
monic analysis, II*

*Geometric applications of operator  
algebras and index theory, II*

*Quadratic forms and division alge-  
bras, II*

*Advances in function theoretic  
methods, II*

*Wavelets and their applications, II*

*Geometry and topology of moduli  
spaces, I*

## SESSIONS FOR CONTRIBUTED PAPERS

## CONTRIBUTED PAPER SESSIONS

*Applied geometry, I*

*Restructuring teaching and learning  
in linear algebra, I*

2:15 p.m. – 4:15 p.m.

## MINICOURSE #5 (PART A)

*Unifying themes for discrete  
mathematics*

## MINICOURSE #6 (PART A)

*The mathematics of the perfect  
shuffle*

## MINICOURSE #7 (PART A)

*Theorist*

2:15 p.m. – 6:00 p.m.

## COMMITTEE ON COMPUTERS IN MATHEMATICS EDUCATION (CCIME) ELECTRONIC POSTER SESSION

*Interactive mathematics texts: using  
technology for active learning*

# Timetable

**Wednesday,  
January 12 (cont'd)**

**American  
Mathematical Society**

**Mathematical  
Association of America**

**Other  
Organizations**

**AFTERNOON (cont'd)**

3:20 p.m.–4:10 p.m.

**INVITED ADDRESS**  
*Circle packing and conformal  
mapping*  
**Brad G. Osgood**

**AWM PANEL DISCUSSION**

4:20 p.m.–5:50 p.m.

**AWM PRIZE SESSION AND  
BUSINESS MEETING**

4:25 p.m.–5:15 p.m.

**INVITED ADDRESS**  
*Overview and update on Fermat's Last Theorem*  
**Kenneth A. Ribet**

4:30 p.m.–6:30 p.m.

**MINICOURSE #1 (PART B)**  
*Organizing an undergraduate  
research program*

**MINICOURSE #2 (PART B)**  
*Inverse problems in the  
undergraduate classroom*

**MINICOURSE #3 (PART B)**  
*The Joy of Mathematica:  
a point-and-click way to use  
and learn Mathematica*

4:30 p.m.–6:30 p.m.

**SECTION OFFICERS MEETING**

5:05 p.m.–5:55 p.m.

**NATIONAL SCIENCE FOUNDATION INVITED ADDRESS**

**EVENING**

6:00 p.m.–7:00 p.m.

**SOCIAL FOR FIRST-TIME ATTENDEES**

# Timetable

Wednesday, January 12 (cont'd)	American Mathematical Society	Mathematical Association of America	Other Organizations
<b>EVENING</b> (cont'd)			
6:30 p.m.–8:15 p.m.			MATHEMATICIANS AND EDUCATION REFORM NETWORK BANQUET
8:30 p.m.–9:30 p.m.	JOSIAH WILLARD GIBBS LECTURE <i>Necessity and chance: deterministic chaos in ecology and evolution</i> Robert M. May		
9:30 p.m.–11:00 p.m.			AWM RECEPTION
<b>Thursday, January 13 MORNING</b>			
7:00 a.m.–4:40 p.m.	EMPLOYMENT REGISTER INTERVIEW SCHEDULE DISTRIBUTION EMPLOYMENT REGISTER INTERVIEWS		
8:15 a.m.–4:40 p.m.			
7:30 a.m.–4:00 p.m.	REGISTRATION FOR JOINT MEETINGS		
8:00 a.m.–10:55 a.m.	SPECIAL SESSIONS <i>Algebraic topology and dynamical systems, III</i>  <i>Singular boundary value prob- lems, III</i>  <i>Operator theory, nonself adjoint operator algebras and control theory, III</i>  <i>Representation theory and har- monic analysis, III</i>  <i>Geometry and topology of moduli spaces, II</i>		



# Timetable

Thursday,  
January 13 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

## MORNING (cont'd)

8:00 a.m.–10:55 a.m.

*Geometric applications of operator algebras and index theory, III*

CONTRIBUTED PAPER SESSION  
*Applied geometry, II*

*Quadratic forms and division algebras, III*

*Advances in function theoretic methods, III*

*Wavelets and their applications, III*

SESSIONS FOR CONTRIBUTED PAPERS

8:00 a.m.–10:00 a.m.

MINICOURSE #8 (PART A)  
*Introduction to research in the teaching and learning of undergraduate mathematics: examples in calculus*

MINICOURSE #9 (PART A)  
*The math modeling/precalculus reform project: using discrete mathematical models to motivate mathematics*

8:00 a.m.–9:20 a.m.

AMATYC-MAA-NCTM PANEL DISCUSSION  
*In the year 2000: who will your students be and what will they know about mathematics?*

8:00 a.m.–9:50 a.m.

STRENGTHENING UNDERREPRESENTED MINORITY MATHEMATICS ACHIEVEMENT (SUMMA) WORKSHOP  
*Intervention projects for minority precollege students*

8:00 a.m.–10:55 a.m.

STUDENT CHAPTERS SPECIAL PAPER SESSION

9:00 a.m.–9:50 a.m.

AWM EMMY NOETHER LECTURE  
*Analysis in gauge theory*  
**Lesley M. Sibner**

9:00 a.m.–9:50 a.m.

CCIME SPECIAL PRESENTATION  
*The promise of interactive texts*  
**James E. White**

# Timetable

Thursday,  
January 13 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

MORNING (cont'd)

9:00 a.m.–5:00 p.m.

BOOK SALE

BOOK SALE

EXHIBITS

10:05 a.m.–10:55 a.m.

INVITED ADDRESS  
*What does it mean to understand a  
mathematical concept? It depends  
on your point of view*  
**Stephen Monk**

11:10 a.m.–noon

AMS-MAA INVITED ADDRESS  
*Random walks and volume*  
**László Lovász**

AFTERNOON

noon–1:00 p.m.

NATIONAL SCIENCE FOUNDATION  
Informal Discussion Group

12:15 p.m.–12:45 p.m.

BUSINESS MEETING

1:00 p.m.–2:00 p.m.

COLLOQUIUM LECTURE, II  
*Harmonic analysis and nonlinear  
evolution equations*  
**Jean Bourgain**

2:15 p.m.–3:05 p.m.

INVITED ADDRESS  
*Reflecting Brownian motions*  
**Ruth J. Williams**

2:15 p.m.–4:10 p.m.

AMS-MAA SPECIAL SESSION  
*Mathematics and education reform, III*

SPECIAL SESSIONS  
*Algebraic topology and dynamical  
systems, IV*

*Singular boundary value problems, IV*

*Operator theory, nonself adjoint oper-  
ator algebras and control theory, IV*

*Representation theory and harmonic  
analysis, IV*

*Geometry and topology of moduli  
spaces, III*

CONTRIBUTED PAPER SESSIONS  
*Actuarial mathematics education and  
research*

*Environmental mathematics, II*

*Favorite nontraditional calculus  
assignments or projects, II*

*Teaching mathematics with a spread-  
sheet, II*

# Timetable

Thursday,  
January 13 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

## AFTERNOON (cont'd)

2:15 p.m.—4:10 p.m.

*Geometric applications of operator  
algebras and index theory, IV*

*Quadratic forms and division  
algebras, IV*

*Advances in function theoretic  
methods, IV*

*Wavelets and their applications, IV*

SESSIONS FOR CONTRIBUTED  
PAPERS

CUPM SUBCOMMITTEE ON AS-  
SESSMENT OPEN FORUM  
*Guidelines for an effective assess-  
ment program for the undergraduate  
major*

PANEL DISCUSSION  
*Creating a climate for change—math  
leads the way*

CUPM SUBCOMMITTEE ON UN-  
DERGRADUATE RESEARCH IN  
MATHEMATICS-COUNCIL ON  
UNDERGRADUATE RESEARCH-  
COMMITTEE ON STUDENT CHAP-  
TERS POSTER SESSION  
*Research by undergraduate students*

2:15 p.m.—4:15 p.m.

MINICOURSE #4 (PART B)  
*How to make effective use of inex-  
pensive pocket computers to develop  
the concepts and techniques of  
calculus*

MINICOURSE #5 (PART B)  
*Unifying themes for discrete  
mathematics*

MINICOURSE #6 (PART B)  
*The mathematics of the perfect  
shuffle*

MINICOURSE #7 (PART B)  
*Theorist*

3:20 p.m.—4:10 p.m.

INVITED ADDRESS  
*The fundamental role of solitons in  
nonlinear dispersive PDEs*  
**James M. Hyman**

4:25 p.m.—5:45 p.m.

AMS-MAA PRIZE SESSION

5:45 p.m.—6:30 p.m.

AMS-MAA PRIZE SESSION RECEPTION

# Timetable

Thursday,  
January 13 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

## EVENING

5:45 p.m.—7:00 p.m.

TWO-YEAR COLLEGE RECEPTION

7:00 p.m.—8:00 p.m.

JPBM AND THE SCIENCE POLICY COMMITTEES  
OF THE AMS, MAA, AND SIAM INVITED ADDRESS

7:00 p.m.—8:15 p.m.

CALCULUS REFORM  
WORKSHOP REUNION

7:15 p.m.—8:15 p.m.

HUMANISTIC MATH NETWORK  
INFORMAL GATHERING

7:30 p.m.—10:00 p.m.

CONTRIBUTED PAPER SESSION  
*Restructuring teaching and learning in  
linear algebra, II*

Friday,  
January 14

## MORNING

7:30 a.m.—4:00 p.m.

REGISTRATION FOR JOINT MEETINGS

8:15 a.m.—4:40 p.m.

EMPLOYMENT REGISTER INTERVIEWS

8:00 a.m.—10:55 a.m.

SPECIAL SESSIONS  
*Topology of high dimensional  
manifolds, I*

*History of mathematics, I*

*Undergraduate research in math-  
ematics, I*

*C\*-algebras and von Neumann alge-  
bras, I*

CONTRIBUTED PAPER SESSIONS  
*Mathematics and music, I*

*New methods for teaching elemen-  
tary differential equations, I*

*Reassessing discrete mathematics in  
the first two years, I*

# Timetable

**Friday,  
January 14 (cont'd)**

**American  
Mathematical Society**

**Mathematical  
Association of America**

**Other  
Organizations**

## **MORNING (cont'd)**

8:00 a.m.–10:55 a.m.

*Quasiconformal mappings in  
analysis, I*

*Modern methods in continuum  
theory, I*

*Stochastic analysis, I*

*Scientific computing, I*

*Nonlinear partial differential equations  
and applications, I*

**SESSIONS FOR CONTRIBUTED  
PAPERS**

*Restructuring the mathematical  
preparation of teachers, I*

8:00 a.m.–10:55 a.m.

**CUPM SUBCOMMITTEE ON CAL-  
CULUS REFORM IN THE FIRST  
TWO YEARS (CRAFTY) AND THE  
CALCULUS REFORM STUDY  
GROUP POSTER SESSION**  
*Calculus projects maturing—a  
chance to see what is emerging*

8:00 a.m.–9:20 a.m.

**PANEL DISCUSSION**  
*Issues in implementing the  
MAA/AMATYC guidelines*

8:00 a.m.–9:20 a.m.

**PANEL DISCUSSION**  
*Writing mathematics courses: a  
maturing discipline*

8:00 a.m.–10:00 a.m.

**MINICOURSE #10 (PART A)**  
*q-dimensional dynamical systems  
and chaos*

**MINICOURSE #11 (PART A)**  
*HP 48 learning environments for  
experienced users*

**MINICOURSE #12 (PART A)**  
*Creating order out of chaos in fresh-  
man mathematics*

**MINICOURSE #13 (PART A)**  
*"Workshop" mathematics: using new  
pedagogy and technology in intro-  
ductory mathematics courses*

# Timetable

Friday,  
January 14 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

MORNING (cont'd)

8:00 a.m.–10:55 a.m.

TEX PRESENTATION

9:00 a.m.–9:50 a.m.

INVITED ADDRESS  
*Carmichael numbers*  
**Carl Pomerance**

9:00 a.m.–5:00 p.m.

BOOK SALE

BOOK SALE

EXHIBITS

9:30 a.m.–10:55 a.m.

PANEL DISCUSSION  
*Aspects of humanistic mathematics*

HEARING ON PRECALCULUS  
REFORM  
*Project on standards for two-year  
college and lower division mathemat-  
ics below the level of calculus*

10:05 a.m.–10:55 a.m.

INVITED ADDRESS  
*Wavelets, filters, and unitary  
matrices*  
**Gilbert Strang**

11:10 a.m.–noon

AMS-MAA INVITED ADDRESS  
*Some propositions from Newton's Principia*  
**Subrahmanyam Chandrasekhar**

AFTERNOON

noon–1:00 p.m.

NATIONAL SCIENCE FOUNDATION  
Informal Discussion Group

12:10 p.m.–12:50 p.m.

BUSINESS MEETING

# Timetable

Friday,  
January 14 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

AFTERNOON (cont'd)

1:00 p.m.–2:00 p.m.

COLLOQUIUM LECTURE, III  
*Harmonic analysis and nonlinear  
evolution equations*  
**Robert M. May**

1:00 p.m.–2:30 p.m.

LIBRARY COMMITTEE AND  
ELECTRONIC PRODUCTS AND  
SERVICES COMMITTEE  
PANEL DISCUSSION  
*Impact of electronic publications on  
the mathematics and library  
communities*

1:00 p.m.–6:00 p.m.

SPECIAL SESSIONS  
*Topology of high dimensional  
manifolds, II*

CONTRIBUTED PAPER SESSIONS  
*Research in undergraduate  
mathematics education, I*

*History of mathematics, II*

*Restructuring teaching and learning in  
linear algebra, III*

*Undergraduate research in math-  
ematics, II*

*Meetings of mathematicians, I*

*C\*-algebras and von Neumann  
algebras, II*

*Quasiconformal mappings in  
analysis, II*

*Modern methods in continuum  
theory, II*

*Stochastic analysis, II*

*Scientific computing, II*

*Nonlinear partial differential equa-  
tions and applications, II*

SESSIONS FOR CONTRIBUTED  
PAPERS

1:00 p.m.–3:00 p.m.

MINICOURSE #14 (PART A)  
*Interactive computer graphics  
laboratories for introductory  
differential geometry*

MINICOURSE #15 (PART A)  
*Designing question-based  
mathematics courses*



# Timetable

Friday,  
January 14 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

AFTERNOON (cont'd)

1:00 p.m.–6:00 p.m.

POSTER SESSION  
*Laboratory approaches in under-graduate mathematics*

2:15 p.m.–3:05 p.m.

RETIRING PRESIDENTIAL  
ADDRESS  
*Experimentation and conjecture are not enough*  
**Deborah Tepper Haimo**

2:15 p.m.–4:10 p.m.

ROCKY MOUNTAIN MATHEMATICS  
CONSORTIUM BOARD OF  
DIRECTORS' MEETING

3:15 p.m.–5:00 p.m.

NATIONAL ASSOCIATION OF  
MATHEMATICIANS (NAM) SESSION  
*Presentations by recent  
doctoral recipients*

3:15 p.m.–5:15 p.m.

MINICOURSE #16 (PART A)  
*Calculus: an active approach with  
projects*

MINICOURSE #17 (PART A)  
*Teaching applied math via Maple*

3:20 p.m.–5:00 p.m.

TEACHING AWARDS SESSION  
**Paul R. Halmos**  
**Justin J. Price**  
**Alan C. Tucker**

5:00 p.m.–6:15 p.m.

AMS-MAA-SIAM COMMITTEE ON EMPLOYMENT OPPORTUNITIES-YOUNG  
MATHEMATICIANS NETWORK PANEL DISCUSSION  
*What can be done about employment of mathematicians in the 90s and beyond?*

5:30 p.m.–6:30 p.m.

MATHEMATICAL REVIEWS  
RECEPTION

SPECIAL PRESENTATION  
*NSF calculus institute using CAS*

# Timetable

**Friday,  
January 14 (cont'd)**

**American  
Mathematical Society**

**Mathematical  
Association of America**

**Other  
Organizations**

## **EVENING**

5:30 p.m.—8:00 p.m.

**NAM BANQUET  
AND COX-TALBOT ADDRESS**  
*Challenges and opportunities for  
minorities in science and  
amthematics*  
**Etta Z. Falconer**

6:30 p.m.—7:20 p.m.

**POETRY READINGS**

7:00 p.m.—8:30 p.m.

**CALCULUS REFORM  
STUDY GROUP OPEN MEETING**

7:30 p.m.—8:20 p.m.

**STUDENT CHAPTERS LECTURE**  
*Magic tricks, card shuffling, and  
computer memories*  
**S. Brent Morris**

8:15 p.m.—10:00 p.m.

**COMMITTEE ON THE  
PARTICIPATION OF WOMEN  
SPECIAL PRESENTATION**  
*Microinequities skits—the  
second generation*

8:45 p.m.—9:30 p.m.

**AMS-MAA DRAMATIC PRESENTATION**  
*Gauss, Eisenstein, and the "third" proof of the quadratic  
reciprocity theorem: Ein kleines Schauspiel*

**Saturday,  
January 15  
MORNING**

7:30 a.m.—2:00 p.m.

**REGISTRATION FOR JOINT MEETINGS**

# Timetable

Saturday,  
January 15 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

MORNING (cont'd)

8:00 a.m.–10:55 a.m.

## SPECIAL SESSIONS

*Topology of high dimensional manifolds, III*

*History of mathematics, III*

*Undergraduate research in mathematics, III*

*C\*-algebras and von Neumann algebras, III*

*Quasiconformal mappings in analysis, III*

*Modern methods in continuum theory, III*

*Stochastic analysis, III*

*Scientific computing, III*

*Nonlinear partial differential equations and applications, III*

## SESSIONS FOR CONTRIBUTED PAPERS

8:00 a.m.–10:00 a.m.

## MINICOURSE #8 (PART B)

*Introduction to research in the teaching and learning of undergraduate mathematics: examples in calculus*

## MINICOURSE #9 (PART B)

*The math modeling/precalculus reform project: using discrete mathematical models to motivate mathematics*

8:00 a.m.–noon

## CONTRIBUTED PAPER SESSIONS

*The bridge to calculus, I*

*Research in undergraduate mathematics education, II*

# Timetable

**Saturday,  
January 11 (cont'd)**

**American  
Mathematical Society**

**Mathematical  
Association of America**

**Other  
Organizations**

**MORNING (cont'd)**

9:00 a.m.–10:55 a.m.

**SPECIAL SESSION**  
*Meetings of mathematicians, II*

9:00 a.m.–9:50 a.m.

**NAM CLAYTOR LECTURE**  
*A novel approach to turbulent  
modeling*  
**John C. Turner, Jr.**

9:00 a.m.–noon

**BOOK SALE**

**BOOK SALE**

**EXHIBITS**

10:00 a.m.–10:55 a.m.

**NAM PANEL DISCUSSION**  
*NAM's undergraduate MATHFest;  
one approach to the pipeline issue*

10:05 a.m.–10:55 a.m.

**INVITED ADDRESS**  
*Euler's extraordinary sums*  
**William W. Dunham**

11:10 a.m.–12:20 p.m.

**100TH ANNUAL MEETING  
CELEBRATION**

**AFTERNOON**

noon–1:00 p.m.

**NATIONAL SCIENCE FOUNDATION**  
Informal Discussion Group

1:00 p.m.–2:00 p.m.

**RETIRING PRESIDENTIAL  
ADDRESS**  
*Noncommutative projective geometry*  
**Michael Artin**

# Timetable

Saturday,  
January 15 (cont'd)

American  
Mathematical Society

Mathematical  
Association of America

Other  
Organizations

AFTERNOON (cont'd)

1:00 p.m.—2:00 p.m.

PANEL DISCUSSION  
*Assessing calculus reform efforts—a  
report to the community*

1:00 p.m.—3:00 p.m.

STUDENT WORKSHOP  
*Calculated deceptions*

1:00 p.m.—3:00 p.m.

MINICOURSE #10 (PART B)  
*q-dimensional dynamical systems  
and chaos*

MINICOURSE #11 (PART B)  
*HP 48 learning environments for  
experienced users*

MINICOURSE #12 (PART B)  
*Creating order out of chaos in fresh-  
man mathematics*

MINICOURSE #13 (PART B)  
*"Workshop" mathematics: using new  
pedagogy and technology in intro-  
ductory mathematics courses*

1:00 p.m.—5:30 p.m.

CONTRIBUTED PAPER SESSIONS  
*The bridge to calculus, II*

*Mathematics and music, II*

*New methods for teaching elemen-  
tary differential equations, II*

*Reassessing discrete mathematics in  
the first two years, II*

*Restructuring the mathematical  
preparation of teachers, II*

2:10 p.m.—4:00 p.m.

PANEL DISCUSSION  
*What happens after calculus reform?*

**Timetable**

<b>Saturday, January 15 (cont'd)</b>	<b>American Mathematical Society</b>	<b>Mathematical Association of America</b>	<b>Other Organizations</b>
<b>AFTERNOON (cont'd)</b>			
2:15 p.m.–5:30 p.m.	<p><b>SPECIAL SESSION</b> <i>Topology of high dimensional manifolds, IV</i></p> <p><i>Undergraduate research in mathematics, IV</i></p> <p><i>C*-algebras and von Neumann algebras, IV</i></p> <p><i>Quasiconformal mappings in analysis, IV</i></p> <p><i>Modern methods in continuum theory, IV</i></p> <p><i>Stochastic analysis, IV</i></p> <p><i>Nonlinear partial differential equations and applications, IV</i></p> <p><b>SESSIONS FOR CONTRIBUTED PAPERS</b></p>		
2:15 p.m.–3:00 p.m.	<p><b>PANEL DISCUSSION</b> <i>Future AMS meetings</i></p>		<b>NAM BUSINESS MEETING</b>
2:15 p.m.–6:00 p.m.		<p><b>SPECIAL SESSION</b> <i>Curriculum projects in undergraduate mathematics</i></p>	
2:45 p.m.–4:00 p.m.		<p><b>CUPM SUBCOMMITTEE ON QUANTITATIVE LITERACY OPEN MEETING</b></p>	

# Timetable

Saturday, January 15 (cont'd)	American Mathematical Society	Mathematical Association of America	Other Organizations
AFTERNOON (cont'd)			
3:15 p.m.—5:15 p.m.		<p>MINICOURSE #14 (PART B) <i>Interactive computer graphics laboratories for introductory differential geometry</i></p> <p>MINICOURSE #15 (PART B) <i>Designing question-based mathematics courses</i></p> <p>MINICOURSE #16 (PART B) <i>Calculus: an active approach with projects</i></p> <p>MINICOURSE #17 (PART B) <i>Teaching applied math via Maple</i></p>	
3:15 p.m.—5:30 p.m.	SPECIAL SESSION <i>Meetings of mathematicians, III</i>		
3:15 p.m.—4:45 p.m.		<p>COMMITTEE ON MATHEMATICIANS OUTSIDE ACADEMIA PANEL DISCUSSION <i>Mathematical life outside academia—input from the real world</i></p>	
6:15 p.m.—10:00 p.m.	BANQUET		



# Mathematical Sciences Employment Register

## Cincinnati Convention Center

January 12, 13, & 14, 1994

### 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.

The improved algorithm for scheduling employer-applicant interviews performed well at the 1993 Employment Register. Priority is now 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. Employer requests are also given priority, as are the requests by applicants that applicants designate "high priority". Under this scheduling system employers in 1993 interviewed 100% 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, D.R. Shier, and M. Myers 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 12, 1994, regardless of whether they have registered in advance. Those who will not be able to appear on Wednesday afternoon should not plan to participate. Should unexpected delays occur while travelling, contact the Employment Register Desk at the Cincinnati Convention Center by telephone at 513-784-6010 before 4:00 p.m. EST on Wednesday.

### 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.
- 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 12, 1993, cannot be included in the booklet. The booklet allows employers to examine each candidate's qualifications in advance, which may be advantageous to those applicants. Of the 100 applicants who were most requested by the employers at the 1993 Employment Register, 95 had registered in time to get their Résumé Forms printed in the booklet.
- Applicants registered in advance will receive their badges, programs, and Employment Register materials two to three weeks in advance of the meeting, unless they indicate otherwise. The package will include the complete job announcements received from employers registered by November 12.

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 12**. These forms must be accompanied by payment of the appropriate fees. Applicant Résumé Forms received by the November 12 deadline will be included in the *Winter List*. Advance registration for the Employment Register will continue until the Final Registration deadline of **December 13, 1993**, 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 13 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 1993 Employment Register in San Antonio the ratio of applicants to interviewers was close to seven applicants to one interviewer.
- The employers who responded to the 1993 follow-up survey (78%) reported giving 94 invitations for on-campus interviews to Employment Register applicants, and they reported making 44 job offers to applicants.
- In San Antonio the average total number of interviews for each applicant was between five and six.
- Most jobs listed required a doctorate.
- Most jobs listed have been academic positions at bachelor's-granting institutions.
- Over 50% of the employers interviewing at the Employment Register in San Antonio 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. 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 Cincinnati 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 12 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 12.

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 12**.

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. Interviewers may work concurrently or may register as only one person and work 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 new schedule allows slightly longer interviews, with five minutes between for note taking.
- One or more interviewers 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 report that they met with excellent candidates among the group of applicants who had requested interviews with them.

Employers should bring school catalogs or corporate reports to the Employment Register Desk 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 13** may register on site in Cincinnati 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 12** 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 12.**

### 1994 Employment Register Schedule

#### Wednesday, January 12

- 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.
- 2:00 p.m.–3:15 p.m. Panel discussion, *Effective job seeking in today's market*.
- **N.B. No interviews are held on Wednesday.**

#### Thursday, January 13

- 7:00 a.m. Distribution of interview schedules for both Thursday and Friday.
- 8:15 a.m.–4:40 p.m. Interviews.

#### Friday, January 14

- 8:15 a.m.–4:40 p.m. Interviews.

**All participants in the 1994 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. 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*, formerly the December issue of *Employment Information in the Mathematical Sciences (EIMS)*, 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 12 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 meeting in Cincinnati also may submit the Applicant Résumé Form at the back of this issue for publication in the *Winter List of Applicants*. Please indicate you are not attending the meeting and observe the deadline of November 12. 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 12. 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 12 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, 401-455-4142, or by e-mail: cak@math.ams.org. The telephone number at the Register in Cincinnati is 513-784-6010. This number will be in service only during the hours the Register is open in Cincinnati. Participants should note that this number is to be used for contacting the Employment Register Desk and is not for contacting participants nor for taking messages. Those who wish to leave messages should call the message center telephone number, 513-784-6011, during the hours that the Meetings Registration Desk is open.

# Short Course, Cincinnati, Ohio

## January 10–11, 1994

### *Complex dynamics: the mathematics behind the Mandelbrot and Julia sets*

The American Mathematical Society, in conjunction with its one hundredth Annual Meeting, will present a two-day Short Course on *Complex dynamics: the mathematics behind the Mandelbrot and Julia sets* on Monday and Tuesday, January 10 and 11, 1994, at the Cincinnati Convention Center, Cincinnati, Ohio. This program of introductory survey lectures is under the direction of **Robert L. Devaney**, Boston University.

Over the past decade alluring computer graphics images of the Mandelbrot and Julia sets have become commonplace in mathematics. Few people realize, however, that the mathematics behind these images is equally beautiful. In this Short Course several of the leaders in the field of complex dynamics will give an overview of the mathematical ideas behind these images. Topics to be discussed include the theory of external rays for quadratic polynomials, the geometry of the Mandelbrot set, the chaotic dynamics on Julia sets, and the computer algorithms used to generate these images. Other talks will center around recent developments in the study of cubic polynomials, rational maps, entire functions, and functions arising in Newton's method.

#### *Tentative Schedule*

##### **Monday, January 10, 1994**

**Robert L. Devaney**, *Overview of quadratic dynamics.*

**Linda Keen**, Herbert H. Lehman College, CUNY, *Julia sets.*

**Adrien Douady**, Université de Paris, Sud, *The parabolic implosion.*

##### **Tuesday, January 11, 1994**

**John H. Hubbard**, Cornell University, *The spider algorithm.*

**Bodil Branner**, Technical University of Denmark, *The dynamics of complex cubic polynomials with disconnected Julia sets.*

**Paul R. Blanchard**, Boston University, *The dynamics of Newton's method.*

**Robert L. Devaney**, *Dynamics of entire functions.*

Synopses and accompanying reading lists follow. 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: \$70 (\$30 student/unemployed/emeritus). On-site registration fee: \$85 (\$40 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.

#### **Synopses and Reading Lists**

##### • *Overview of quadratic dynamics* (Robert L. Devaney).

The goal of this lecture is to give an overview of some of the topics to be covered in the Short Course, with particular emphasis on the simplest setting for complex dynamics, namely, the iteration of quadratic polynomials. Using a series of computer experiments, we will describe both the tame and chaotic behavior of these maps. We will show how the complicated dynamics occurs on a set of points known as the Julia set. For quadratic polynomials this set assumes one of two shapes: either the set is connected or else it is totally disconnected. This fundamental dichotomy provides us with the definition of the Mandelbrot set. We will show that this set also has an equivalent "dynamical" definition involving the fate of the critical orbit. Finally, we will discuss Douady and Hubbard's theory of external rays, which may be used to describe the dynamical structure of the Julia set and the Mandelbrot set.

#### **References**

[1] Blanchard, P., *Complex analytic dynamics on the Riemann sphere*, Bull. Amer. Math. Soc. (N.S.) **11** (1984), 85–141.

[2] Branner, B., *The Mandelbrot set*, In Chaos and Fractals, Proc. Sympos. Appl. Math. **39** (1989), 75–105.

[3] Devaney, R., *The orbit diagram and the Mandelbrot set*, Coll. Math. J. **22** (1991), 23–38.

[4] Douady, A. and Hubbard, J., *Itération des Polynômes Quadratiques Complexes*, CR Acad. Sci. Paris **29** (1982), 123–126.

• *Julia sets* (Linda Keen). In this lecture we will discuss the orbit structures of complex quadratic polynomials. These orbits naturally fall into two categories: tame or stable and chaotic or unstable. We shall give a full classification of the stable dynamics including a sketch of Sullivan's proof that the connected components of the stable region containing tame orbits are eventually periodic. The main ideas in this classification are, first, that the orbits of the critical points govern the dynamics and, second, that the family of quadratic polynomials is inherently one dimensional.

We shall also discuss the orbits of points in the unstable, or Julia, set. The geometry of this set is delicate and very complicated. There are now many computer pictures available that indicate the tremendous variety and beauty to be found in these sets. We do not yet have a complete theory for the unstable behavior, but we shall give a full description for the large subfamily of polynomials whose critical orbits lie in the stable set.

## References

- [1] Beardon, A., *Iteration of rational functions*, Grad. Texts in Math. 132 (1991).
- [2] Blanchard P., *Complex analytic dynamics on the Riemann sphere*, Bull. Amer. Math. Soc. (N.S.) 11 (1984), 85–141.
- [3] Keen, L., *Julia sets*, In Chaos and Fractals, Proc. Sympos. Appl. Math. 39 (1989), 57–84.
- [4] Milnor, J., *Dynamics in one complex variable: introductory lectures*, IMS SUNY-Stony Brook preprint series, #1990/5.
- [5] Peitgen, H.O. and Richter, P.H., *The beauty of fractals*, Springer-Verlag, 1986.
- [6] Sullivan, D., *Conformal dynamical systems*, in Geometric Dynamics, Springer-Verlag Lecture Notes 1007 (1983), 725–752.

• **The spider algorithm** (John H. Hubbard). Let  $P_c(z) = z^2 + c$ . The Mandelbrot set is the set

$$M = \{c \in \mathbb{C} \mid \text{the sequence } c, P_c(c), P_c(P_c(c)), \dots \text{ is bounded}\}.$$

This set is known to be connected [DH], and a detailed description depends on the **conformal mapping of the complement**: there exists a unique isomorphism

$$\phi_M: \mathbb{C} - M \rightarrow \mathbb{C} - D.$$

Call

$$R_\theta(r) = \phi_M^{-1}(re^{2\pi i\theta}), \quad r > 1,$$

the external ray of  $M$  at angle  $\theta$ . We will say that  $R_\theta$  lands if

$$\lim_{r \searrow 1} R_\theta(r)$$

exists; it is conjectured that all rays land, but this is still unproved. However, it is proved for  $\theta \in \mathbb{Q}$ , which will be the main case of interest to us.

The principle of the description of  $M$  is that there is a remarkable correspondence between the digits of  $\theta$  written in base 2 and the dynamics of the polynomial at which  $R_\theta$  lands.

**Example.** The ray at angle  $1/6$  lands at  $i$ . The number  $1/6$  is written in base 2

$$1/6 = .00\overline{1}$$

whereas the orbit of 0 under  $z \mapsto z^2 + i$  is

$$0 \mapsto i \mapsto -1 + i \mapsto -i \mapsto -1 + i \dots$$

Both, after one iteration repeat with period 2.

In our lecture we will try to explain this phenomenon.

**The spider algorithm:** Our description will start with a number  $\theta \in \mathbb{Q}/\mathbb{Z}$  and will show how to find the landing point of the ray at angle  $\theta$  on  $M$ . The underlying algorithm is due to Thurston, and the implementation we will describe is justified theoretically in [BFH].

Suppose  $\theta$  in reduced form has an even denominator, let  $\theta_j = 2^j \theta \bmod 1$ , and define the *standard  $\theta$  spider*

$$S_\theta = \bigcup_i re^{2\pi i\theta_j}, \quad r \geq 1.$$

The spider algorithm is a mapping  $\sigma_\theta$  in the space

$$S_0 = \{\phi: S_0 \rightarrow \overline{\mathbb{C}}\}$$

where  $\phi$  is injective, respects the circular order at  $\infty$ , and satisfies  $\phi(e^{2\pi i\theta}) = 0$ .

The mapping  $\sigma_\theta: S_\theta \rightarrow S_\theta$  is a mapping which chooses a lift of a spider by the mapping  $x_2(1 + z/2)^2$ , where  $x_2 = \phi(e^{2\pi i\theta_2})$ , where the legs of the spider allow us to choose the correct inverse image.

We will see that this algorithm converges, although there are subtleties, and the tips of the legs may not remain distinct; and that the limit is a polynomial whose dynamics give the digits of  $\theta$ .

## References

- [1] Bielefeld, B., Fisher, Y., and Hubbard, J., *A classification of critically finite polynomials*, J. Amer. Math. Soc. (1992).
- [2] Douady, A. and Hubbard J., *Etude dynamique des polynômes complexes*, Publ. Math. Orsay.

• **The parabolic implosion** (Adrien Douady). This lecture focuses on the following question: Do the Julia set  $J_c$  and the filled Julia set  $K_c$  of the quadratic polynomial  $f_c: z \mapsto z^2 + c$  depend continuously on  $c$ ?

The question will first be made precise by defining the Hausdorff distance  $d(A, B) = \sup(\partial(A, B), \partial(B, A))$ , where  $\partial(A, B) \leq r \Leftrightarrow \forall x \in A \quad d(x, B) \leq r$ . Then continuity of  $\lambda \mapsto A_\lambda$  splits into upper and lower semicontinuity, which have different geometric interpretations. For example, if  $\{(\lambda, x) \mid x \in A_\lambda\}$  is compact,  $\lambda \mapsto A_\lambda$  is upper semicontinuous. We shall see that  $c \mapsto K_c$  is always u.s.c. and  $c \mapsto J_c$  always l.s.c. As a consequence they are both continuous at  $c_0$  if  $\overset{\circ}{K}_{c_0} = \emptyset$ .

Then we shall describe and analyze briefly the discontinuity which occurs at  $c_0 = 1/4$  (more generally at parabolic points).

• **The dynamics of complex cubic polynomials with disconnected Julia sets** (Bodil Branner).

Many global dynamical properties can be derived from a knowledge of the behavior of the critical points under iteration. For instance, the Julia set of a polynomial is connected if and only if all critical points have bounded orbits and totally disconnected if all critical points tend to  $\infty$  under iteration. Since a quadratic polynomial has only one critical point, the Julia set is either connected or totally disconnected. A polynomial of degree  $d > 2$  can have some critical orbits that escape and others that remain bounded. We shall discuss the simplest such case, cubic polynomials with one critical orbit bounded and the other approaching  $\infty$ . We shall give a combinatorial characterization of different types of dynamics for such polynomials. The tableaux technique was developed for cubic polynomials in order to characterize the polynomials with totally disconnected Julia set. We shall also discuss briefly how the results in the dynamical plane are transferred to parameter space. Some of the polynomials behave locally like a quadratic polynomial with connected

Julia set. They belong to Mandelbrot-like families and give rise to copies of the Mandelbrot set in parameter space. Finally, we shall mention how the tableaux technique has been applied for quadratic polynomials to prove results about local connectivity.

## References

- [1] Brolin, H., *Invariant sets under iteration of rational functions*, Arch. Math. **6** (1965), 103–174.
- [2] Branner, B., *The Mandelbrot set*. In Chaos and Fractals, Proc. Sympos. Appl. Math. **39** (1989), 75–105
- [3] Branner, B., *The parameter space for complex cubic polynomials*. In Chaotic Dynamics and Fractals, Academic Press (1986), pp. 169–179.
- [4] Branner, B. and Hubbard, J.H., *The iteration of cubic polynomials, Part II: the patterns and parapatterns*. Acta Math.
- [5] Hubbard, J. H., *Local connectivity of Julia sets and bifurcation loci: three theorems of J.-C. Yoccoz*. In Topological Methods in Modern Mathematics (1993), pp. 467–511.
- [6] Keen, L., *Julia sets*, In Chaos and Fractals, Proc. Sympos. Appl. Math. **39** (1989), 57–74.

• **The dynamics of Newton's method** (Paul R. Blanchard). In this lecture we consider the dynamics of a special class of rational functions—the functions that are obtained from Newton's Method as applied to a polynomial equation. Such maps are interesting for two reasons:

- (1) They form a natural family of nonpolynomial examples, and
- (2) their dynamical properties are related to their utility as numerical algorithms.

After reviewing some basic facts we describe a one-parameter family of third degree rational functions derived from Newton's Method applied to cubic equations in one variable. Then in order to explain the results of a related computer experiment, we present the remarkable theory of polynomial-like mappings due to Douady and Hubbard. If time permits we will summarize the work of Manning, Friedman, and Sutherland related to the computational complexity of Newton's Method.

## References

- [1] Beardon A., *Iteration of rational function*, Grad. Texts in Math. **132** (1991).
- [2] Blanchard P., *Complex analytic dynamics on the Riemann sphere*, Bull. Amer. Math. Soc. (N.S.) **11** (1984), 85–141.
- [3] Branner, B., *The Mandelbrot set*, Chaos and Fractals, (Devaney and Keen, eds.) Proc. Sympos. Applied Math. **39** (1989), 75–105.

[4] Curry, J., Garnett, L., and Sullivan, D., *On the iteration of a rational function: computer experiments with Newton's method*, Comm. Math. Phys. **91** (1983), 267–277.

[5] Douady A., *Systèmes dynamiques holomorphes, séminaire Bourbaki 1982/1983*, Exposé 599, Asterisque (1983), 105–106.

[6] Douady, A. and Hubbard, J., *Itération des polynômes quadratiques complexes*, C.R. Acad. Sci. Paris **294** (1982), 123–126.

[7] Douady, A. and Hubbard, J., *Étude dynamique des polynômes complexes*, Publ. Math. Orsay.

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[9] Keen, L., *Julia sets*, Chaos and Fractals, the Mathematics behind the Computer Graphics, (Devaney & Keen, eds.), Proc. Sympos. Appl. Math. **39** (1989), 57–77.

[10] Lyubich, M., *The dynamics of rational transforms: the topological picture*, Russian Math. Surveys **41:4** (1986), 43–117.

[11] Milnor, J., *Dynamics in one complex dimension: introductory lectures*, SUNY Stony Brook, Institute for Mathematical Sciences, preprint #1990/5.

[12] Peitgen, H. O. and Richter, P. H., *The beauty of fractals*, Springer-Verlag, 1986.

• **Dynamics of entire functions** (Robert L. Devaney). In this lecture we will describe how the study of the dynamics of transcendental functions differs from those of polynomial and rational maps. We will show that the parabolic implosion discussed by Douady has a very different outcome in the case of certain entire functions namely, the Julia set explodes. We will show that the Julia sets of these functions often possess interesting topological structures such as Cantor bouquets and Knaster continua. We will also investigate the analogue of the Mandelbrot set for several of these families.

## References

- [1] Baker, I. N. and Rippon, P., *Iteration of exponential functions*, Ann. Acad. Sci. Fenn., Ser. A1 Math. Dissertations **9** (1984), 49–77.
- [2] Devaney, R. L., *Julia sets and bifurcation diagrams for exponential maps*. Bull. Amer. Math. Soc. (N.S.) **11** (1984), 167–171.
- [3] Devaney, R. L. and Durkin, M., *The exploding exponential and other chaotic bursts in complex dynamics*, Amer. Math. Monthly **98** (1991), 217–233.
- [4] Devaney, R. L. and Krych, M., *Dynamics of  $\exp(z)$* , Ergodic Theory and Dynamical Systems **4** (1984), 35–52.
- [5] Eremenko, A. *On the iteration of entire functions*. In Dyn. Syst. and Erg. Theory **23** (1989), 339–345.
- [6] Eremenko, A. and Lyubich, M. Yu., *Iterates of entire functions*. Dokl. Akad. Nauk SSSR **279** (1984), 25–27; English translation in Soviet Math. Dokl. **30** (1984), 592–594.

# Invited Addresses and Special Sessions

## 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. Invited addresses at Sectional Meetings are selected by the Section Program Committee, usually twelve to eighteen months in advance of a meeting. 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.

### Lexington, KY, March 1994

Jack J. Dongarra	George F. McNulty
James E. McClure	David R. Morrison

### Manhattan, KS, March 1994

Marilyn Breen	David M. Goss
Michael C. Cranston	Mei-Chi Shaw

### Brooklyn, NY, April 1994

David Bayer	Debasis Mitra
Peter B. Kronheimer	Nicholai Reshetikhin

### Stillwater, OK, October 1994

V. Lakshmibai	David J. Wright
David E. Marker	Joel Zinn

### Richmond, VA, November 1994

Loren D. Pitt	Doron Zeilberger
Cora S. Sadosky	

## 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 1994 Meeting in Lexington, Kentucky

Southeastern Section  
Associate Secretary: Robert J. Daverman

*Deadline for organizers: Expired*

*Deadline for consideration: December 7, 1993*

James C. Beidleman and Donald B. Coleman, *Infinite groups and group rings*

Philip L. Bowers, *Geometric group theory and metric geometry*

Russell M. Brown, John L. Lewis, and Zhongwei Shen, *Partial differential equations and minimal smoothness condition*

Karen L. Collins and Ewa M. Kubicka, *Graph theory*

Michael B. Freeman, *Collaborative interventions*

Peter D. Hislop and Peter A. Perry, *Inverse spectral problems: theory and computation*

Mark A. Hovey and James E. McClure, *Homotopy theory*

David R. Morrison, *Quantum algebraic geometry*

Serge Ochanine, *Elliptic genera and elliptic cohomology*

Charles H. Romine, *Large-scale matrix computations with applications*

M. Beth Ruskai, *Mathematics of many-body quantum theory*

### March 1994 Meeting in Manhattan, Kansas

Central Section

Associate Secretary: Andy R. Magid

*Deadline for organizers: Expired*

*Deadline for consideration: December 7, 1993*

Andrew G. Bennett and Charles N. Moore, *Harmonic analysis and probability*

Andrew L. Chermak and Albert L. Delgado, *Groups and geometries*

Louis Crane and David N. Yetter, *Quantum topology*

David M. Goss, Michael I. Rosen, and Dinesh Thaker, *Global fields*

Robert A. Gustafson, *Special functions*

A. Alexandrou Himonas and Mei-Chi Shaw, *Several complex variables and partial differential equations*

Lev Kapitanski and Lige Li, *Nonlinear topics and critical phenomena in partial differential equations*

Zongzhu Lin and David B. Surowski, *Representations of algebraic groups and quantum groups*

Gabriel Nagy and Vladimir V. Peller, *Operator theory*

Joseph M. Rosenblatt, *Convergence problems in ergodic theory*

Misha Vishik, *Dynamical systems and fluid dynamics*

Hunan Yang and Qisu Zou, *Computational mathematics and numerical analysis*

### April 1994 Meeting in Brooklyn, New York

Eastern Section

Associate Secretary: Lesley M. Sibner

*Deadline for organizers: Expired*

*Deadline for consideration: January 7, 1994*

Boris Aronov, *Computational geometry*



Craig J. Benham, *Mathematical problems in molecular biology*  
 Joan S. Birman, Sylvain E. Cappell, and Edward Y. Miller,  
*Invariants of low dimensional manifolds*  
 Jozef Dodziuk and Edgar A. Feldman, *Geometric analysis*  
 Benjamin Fine, Anthony M. Gaglione, and Kathryn Kuiken,  
*Combinatorial group theory and related topics*  
 Frederick P. Gardiner and Yunping Jiang, *Teichmüller theory*  
*and dynamical systems*  
 Dorian Goldfeld, *Analytic number theory*  
 Jacob E. Goodman and Erwin Lutwak, *Geometric convexity*  
 Pao-sheng Hsu and L. Narisi, *Topological methods; topological*  
*measure theory*  
 Yanyan Li, *Partial differential equations*  
 Janos Pach and William Steiger, *Discrete geometry*  
 Kurt S. Riedel, *Mathematical methods in plasma physics*  
 Robert J. Sibner, *Gauge theory and applications*  
 Alan A. Weiss, *Models in telecommunications*

**June 1994 Meeting in Eugene, Oregon**

Western Section  
 Associate Secretary: Lance W. Small  
 Deadline for organizers: Expired  
 Deadline for consideration: March 14, 1994

**August 1994 Meeting in Minneapolis, Minnesota**

Associate Secretary: Lesley M. Sibner  
 Deadline for organizers: November 15, 1993  
 Deadline for consideration: April 26, 1994

**October 1994 Meeting in Stillwater, Oklahoma**

Central Section  
 Associate Secretary: Andy R. Magid  
 Deadline for organizers: January 28, 1994  
 Deadline for consideration: July 13, 1994

Ara S. Basmajian and Robert R. Miner, *Complex hyperbolic*  
*geometry and discrete groups*  
 Edward T. Cline, *Representations of algebraic groups*

**November 1994 Meeting in Richmond, Virginia**

Southeastern Section  
 Associate Secretary: Robert J. Daverman  
 Deadline for organizers: February 11, 1994  
 Deadline for consideration: July 13, 1994

**January 1995 Meeting in San Francisco, California**

Associate Secretary: Andy R. Magid  
 Deadline for organizers: April 2, 1994  
 Deadline for consideration: September 9, 1994

**March 1995 Meeting in Hartford, Connecticut**

Eastern Section  
 Associate Secretary: Lesley M. Sibner  
 Deadline for organizers: June 3, 1994  
 Deadline for consideration: To be announced

**March 1995 Meeting in Orlando, Florida**

Southeastern Section  
 Associate Secretary: Robert J. Daverman  
 Deadline for organizers: June 17, 1994  
 Deadline for consideration: To be announced

Robert C. Brigham and Richard P. Vitray, *Combinatorics and*  
*graph theory*  
 John R. Cannon, *Inverse and ill-posed problems*  
 S. Roy Choudhury, *Nonlinear dynamical systems, chaos, and*  
*turbulence*  
 S. Roy Choudhury and Lokenath Debnath, *Solitons and*  
*nonlinear waves*  
 Xin Li and Ram N. Mohapatra, *Approximation theory and*  
*special functions*  
 Piotr Mikusinski, *New trends in generalized functions*  
 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: June 24, 1994  
 Deadline for consideration: To be announced

**November 1995 Meeting in Kent, Ohio**

Central Section  
 Associate Secretary: Andy R. Magid  
 Deadline for organizers: February 4, 1995  
 Deadline for consideration: To be announced

**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*

**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

**January 1997 Meeting in San Diego, California**

Associate Secretary: Lesley M. Sibner  
 Deadline for organizers: April 8, 1996  
 Deadline for consideration: To be announced

**Information for Organizers**

Potential organizers should refer to the January, February, March, or April issues 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.

## Invited Addresses and Special Sessions

### Western Section

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### Eastern Section

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### Southeastern Section

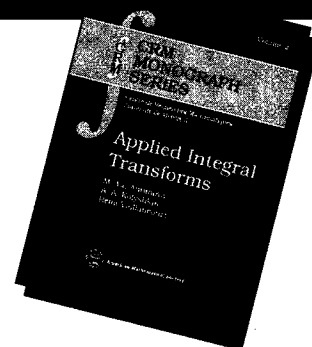
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Knoxville, TN 37996-1300  
E-mail [g\\_daverman@math.ams.org](mailto:g_daverman@math.ams.org)  
Telephone 615-974-6577

Information on site selection for Sectional Meetings as well as full instructions for submitting abstracts can be found in the January, February, March, and April issues of the *Notices*.

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# Winter Meeting of the Canadian Mathematical Society

## December 11–13, 1993

### *Tentative Program*

The Canadian Mathematical Society (CMS) and Carleton University cordially invite mathematicians to the 1993 Winter Meeting of the Society. The entire program will take place at the Westin Hotel in the heart of Ottawa, Ontario, Canada's capital, from Saturday, December 11, to Monday, December 13, 1993. The hotel is located near Parliament Hill, the renowned Byward Market, the National Gallery, the Museum of Civilisation, and the National Arts Centre. Come join us!

#### *Plenary Speakers*

**Gilbert Baumslag**, City University of New York, *title to be announced*, Sunday, 1:45 p.m.;

**David R. Brillinger**, University of California, Berkeley, *Fourier transform in the analysis of scientific data*, Saturday, 9:00 a.m.;

**Heinz O. Peitgen**, Universität Bremen, *Global evolution patterns of cellular automata, fractals, and dynamical systems*, Saturday, 6:00 p.m.;

**Andrew M. Pitts**, University of Cambridge, *Category theory and the semantics of programming languages*, Saturday, 1:45 p.m.; and

**B. A. Taylor**, University of Michigan, Ann Arbor, *Extremal plurisubharmonic functions and the extension of solutions of homogeneous partial differential equations*, Sunday, 9:00 a.m.

#### *Coxeter-James Lecture*

This lecture, given by **Jacques Hurtubise**, McGill University, is titled *Configurations of particles and the topology of moduli spaces* and is scheduled on Sunday, 6:00 p.m. to 7:00 p.m. A formal buffet reception will follow the talk. See the *Social Events* section for details.

#### *Symposia*

Symposia in five domains will take place with session organizers, tentative schedules, and invited speakers as follows:

*Group theory*, organized by **John Dixon**, Carleton University; Saturday, Sunday, and Monday mornings, and Saturday afternoon. G. Baumslag (CUNY), S. M. Gersten (Utah), C. K. Gupta (Manitoba), O. G. Kharlampovich (McGill), J. McCool (Toronto), A. H. Rhemtulla (Edmonton), L. Ribes (Carleton), M. Shirvani (Alberta).

*Probability and statistics*, organized by **J. N. K. Rao**, Carleton University; Saturday and Sunday mornings and afternoons. D. Brillinger (Berkeley), S. Dalal (New Jersey), D. Harrington (Harvard), A. Herzberg (Queen's), D. Krewski

(Carleton), R. Sitter (Carleton), R. Tibshirani (Toronto), K. Worsley (McGill).

*Fractals*, organized by **C. Tricot**, École Polytechnique de Montréal; Sunday and Monday mornings and afternoons. C. Cutler (Waterloo), S. Dubuc (Montréal), J. Harrison (Berkeley), S. Lalley (Purdue), M. L. Lapidus (California), B. Mandelbrot (Yale), H. O. Peitgen (Bremen), E. Vrscay (Waterloo).

*Categorical logic and computer science*, organized by **Philip J. Scott**, University of Ottawa; Saturday, Sunday, and Monday mornings and afternoons. M. Barr (McGill), A. Blass (Ann Arbor), R. Cockett (Calgary), P. Freyd (Philadelphia), A. Joyal (UQAM), M. Makkai (McGill), R. Paré (Dalhousie), A. Pitts (Cambridge), R. Rosebrugh (Mount Allison), A. Scedrov (Philadelphia), R. Seely (McGill).

*Pluripotential theory and approximation*, organized by **Thomas Bloom**, University of Toronto; Saturday and Sunday mornings and afternoons. H. Alexander (Chicago), T. Bagby (Bloomington), L. Bos (Calgary), E. M. Frier (Montréal), N. Levenberg (Auckland), P. Mercer (Chapel Hill), W. Plesniak (Crakow), E. Poletsky (Syracuse), B. A. Taylor (Ann Arbor).

#### *Education Program*

The Mathematics Education Session is being organized by **John Poland**, Carleton University. This program features a plenary lecture on Monday at 9:00 a.m. and two sessions. The first is *Teaching large introductory university courses in mathematics* and the second is *Lean and lively linear algebra*. In addition a special plenary lecture will be given by **Benoît Mandelbrot**, Yale University, on Monday at 1:45 p.m. titled *The texture of fractals: rates of lacunarity*

#### *Contributed Papers*

Contributed papers of fifteen-minutes duration are invited. Abstracts must be prepared on the standard form available from the CMS Office in Ottawa and sent to the Abstracts Coordinator, CMS Executive Office, 577 King Edward, Suite 109, P. O. Box 450, Station A, Ottawa, Ontario, Canada K1N 6N5, so as to arrive by **October 15, 1993**.

Those who use the TeX typesetting system may submit their abstracts by e-mail. Files should include the speaker's name, affiliation, complete address, title of talk, and the abstract itself and be sent to clequel@acadvm1.uottawa.ca.

Most of the papers to be presented at the five Symposia will be by invitation. However, anyone contributing an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these sessions

should indicate this clearly on the abstract. Unfortunately, these abstracts should have been submitted by **September 15, 1993**, in order to be considered for inclusion.

### Social Events

All delegates are invited to a cash-bar welcoming reception scheduled on Friday from 7:00 p.m. to 9:00 p.m. during evening registration.

A buffet reception is scheduled on Sunday, December 12, at 7:30 p.m. and is included in the cost of registration for those registration categories marked by an asterisk (\*). Additional tickets are available for CDN\$40 each, including taxes and gratuity. The menu features breast of chicken with lime and honey sauce; emince of beef with English mustard sauce, bell peppers, and mushroom garnish; rotini with herbs, black olives, vegetables, and feta cheese; and filet of dory grenobloise.

Throughout the meeting we invite you to have complimentary coffee and chat with colleagues during the scheduled morning and afternoon breaks.

### Preregistration

This meeting marks the first time meeting registration will be handled by the CMS Executive Office in Ottawa. This gives delegates a wider range of payment options. Payment for preregistration may be accepted by check, 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 may be found in the September *CMS Notes* or requested from the CMS Executive Office at the address above or by telephone: 613-564-2223 or fax: 613-565-1539.

### Registration fees

(in Canadian dollars)

	Before Oct. 15	After Oct. 15
*CMS/AMS/MAA members with grants	\$180	\$225
*CMS/AMS/MAA members without grants	110	135
*Nonmembers with grants	250	315
*Nonmembers without grants	145	180
Teachers, students, postdocs, retired, unemployed, or Education Session only	55	55
One-day fee	75	75

\*Includes buffet reception on Sunday at 7:30 p.m.

Plenary speakers, prize lecturers, and invited symposia speakers should register using the special registration form available from the chair of the Scientific Programme Committee or from session organizers.

### Accommodations

A large block of rooms has been reserved at the Westin Hotel, 11 Colonel By Drive, Ottawa, Ontario, Canada K1N 9H4; telephone: 613-560-7000; fax: 613-234-5396; telex: 053-4855. The following rates are in effect (in Canadian dollars):

Moderate rooms: Single \$99 Double \$109

Deluxe rooms: Single \$119 Double \$129

**Reservations must be made by November 10, 1993.**

### Travel

The Ottawa International Airport (50 Airport Road; 613-998-8819) has recently been renamed the Macdonald-Cartier Airport and is located toward the south of the city. It is accessible via the Airport Parkway. Airport bus and taxi services are available. Mirabel, the Montréal International Airport, is another point of origin for international destinations. Connecting flights and a two-hour bus shuttle to Ottawa are available. Ottawa is only 55 minutes by air from Pearson International Airport in Toronto. AIR CANADA and CONTINENTAL AIRLINES have been named the official air carriers. In North America call 1-800-361-7585 directly for Air Canada. Any licensed travel agent may also book an Air Canada flight; instruct the agent to enter event number **CV930290** in the tour code box and reference code **CMS** in the endorsement box. Air Canada may also be reached by telephone at these foreign offices:

Frankfurt	25 01 31
London	(081) 7592636
Vienna	(0222) 5861901
Geneva	731 4980
Paris	(1) 43201200
Zurich	2110777

### Acknowledgments

The Scientific Program Committee wishes to extend its thanks to the Natural Sciences and Engineering Research Council (NSERC) for its generous support of the scientific program. Other grants have been received from Carleton University.

The CMS also wishes to acknowledge the contribution of the following committees in presenting these exciting scientific, educational, and social programs:

**Scientific Programme Committee:** T. Bloom (Toronto); J. D. Dixon (Carleton); P. M. Gauthier (Montréal), chair; J. N. K. Rao (Carleton); P. Scott (Ottawa); N. Tomczak-Jaegermann (Alberta), *ex officio*; C. Tricot (École Polytechnique de Montréal); G. P. Wright (Ottawa), *ex officio*.

**Education Session:** John Poland (Carleton).

**Local Arrangements Committee:** Monique Bouchard, (CMS), *ex officio*; Graham Zelmer (Carleton), chair.

1993

1993–1994. **Mittag-Leffler Institute's Academic Program for 1993–1994: Topology and Algebraic  $K$ -theory**, Djursholm, Sweden. (Dec. 1992, p. 1274)

Spring 1993. **IMACS Symposium on Mathematical Modelling**, Wiener Neustadt, Germany. (Jan. 1992, p. 54)

1993. **Second IMACS International Conference on Computational Physics**, Univ. of Colorado, Boulder, CO. (Jan. 1992, p. 55)

### October 1993

15–16. **Thirteenth Meeting of the Southeastern-Atlantic Regional Conference on Differential Equations**, University of North Carolina at Wilmington, Wilmington, NC. (May/Jun. 1993, p. 512)

15–16. **Fifteenth Midwest Probability Colloquium**, Evanston, IL. (May/Jun. 1993, p. 512)

15–17. **Second International Conference on Ordinal Data Analysis**, University of Massachusetts, Amherst, MA. (Mar. 1993, p. 284)

16. **The Midwest Group Theory Seminar**, University of Chicago. (Jul./Aug. 1993, p. 707)

16. **Mathematica Seminar**, Frankfurt University, Frankfurt, Germany. (Jul./Aug. 1993, p. 707)

17–20. **Workshop on Application Specific Symbolic Techniques in High Performance Computing Environments**, The Fields Institute, Waterloo, Ontario, Canada. (Jul./Aug. 1993, p. 707)

17–23. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 57)

18–20. **Workshop on Coding, System Theory, and Symbolic Dynamics**, Boston area. (Apr. 1993, p. 414)

18–20. **Mathematical Analysis of Phenomena in Fluid and Plasma Dynamics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 707)

18–20. **Mathematical Topics in Biology**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 707)

18–20. **1993 MATLAB Conference**, Cambridge, MA. (Jul./Aug. 1993, p. 707)

18–22. **Sixth International Congress on Biomathematics**, Universidad de Costa Rica, San Jose, Costa Rica. (Jul./Aug. 1993, p. 708)

18–22. **IMA Workshop on Finite Markov Chain Renaissance**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 63)

19–22. **1993 International Conference on Network Protocols (ICNP-93)**, San Fran-

cisco, CA. (Jan. 1993, p. 63)

19–22. **Analytic Number Theory**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 708)

20–22. **Stage de Bibliothécaires de Mathématiques**, CIRM, Marseille, France. (Jan. 1993, p. 63)

20–22. **1993 IEEE Workshop on VLSI Signal Processing**, Koningshof, Veldhoven, The Netherlands. (May/Jun. 1993, p. 512)

21–24. **Hirsch Symposium. A Special Midwest Dynamical Systems Seminar in Honor of Professor Morris Hirsch's Sixtieth Birthday**, University of California, Berkeley, CA. (Jul./Aug. 1993, p. 708)

22. **Mathematica Seminar**, Esiee School, Paris, France. (Jul./Aug. 1993, p. 708)

22–23. **Second Symposium on Matrix Analysis and Applications—A Look at Recent Developments**, Western Michigan University, Kalamazoo, MI. (Jul./Aug. 1993, p. 708)

22–23. **Central Section**, Texas A&M University, College Station, Texas.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

24–25. **Symposium in Memory of Ilya Bakelman (1928–1992)**, Texas A&M University, College Station, TX. (Sep. 1993, p. 922)

24–27. **Functional Analysis on the Eve of the Twenty-first Century, in Honor of the Eightieth Birthday of Israel M. Gelfand**, Rutgers University, New Brunswick, NJ. (Sep. 1993, p. 922)

24–30. **Mengenlehre**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 186)

25–26. **Visualization '93 Symposiums**, San Jose, CA. (May/Jun. 1993, p. 512)

25–27. **The State of the Art in Numerical Algorithms and Their Prospects**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 708)

25–27. **Second International Conference**

## Mathematical Sciences Meetings and Conferences

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](mailto: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.

and Workshop on Approximations and Numerical Methods for the Solution of the Maxwell Equations, Washington, DC. (Jul./Aug. 1993, p. 708)

25-29. **Third SIAM Conference on Geometric Design**, Seattle, WA. (Jul./Aug. 1992, p. 632)

27-29. **Mathematical Methods for Wave Phenomena in Fluids and Their Application**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)

27-30. **Seventh International Conference on Domain Decomposition Methods**, Penn State University, State College, PA. (Oct. 1992, p. 950)

27-30. **Joint U.S.-Italian Conference on Hilbert Functions**, MSI, Ithaca, NY. (Jul./Aug. 1993, p. 709)

28-30. **NSF National Conference on Diversity in the Scientific and Technological Workforce**, Washington, DC. (Jul./Aug. 1993, p. 709)

29-30. **1993 Mathematical Sciences Department Chairs Colloquium**, Arlington, VA. (Jul./Aug. 1993, p. 709)

31. **Tutorial on Data Reduction and Decomposition Techniques for Curves and Surfaces**. (May/Jun. 1993, p. 512)

31. **Tutorial on NURBS**, Tempe, AZ. (May/Jun. 1993, p. 512)

31-November 6. **Algorithmische Methoden der Diskreten Mathematik**, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)

## November 1993

1-5. **Third SIAM Conference on Geometric Design**, Tempe, AZ. (Dec. 1992, p. 1284)

3-5. **The Eighth International Symposium on Computer and Information Sciences, ISCIS VIII**, Antalya, Turkey. (Jul./Aug. 1993, p. 709)

4-6. **Study of Structures of Solutions to P.D.E.**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)

6-7. **Western Section**, Harvey Mudd College, Claremont, CA.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

8-10. **Spectral and Scattering Theory and Related Topics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)

9-12. **Singularities of Holomorphic Vector Fields and Related Topics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)

12-13. **Eighth Annual Pi Mu Epsilon Re-**

**gional Undergraduate Mathematics Conference**, St. Norbert College, De Pere, WI. (Ju./Aug. 1993, p. 709)

12-14. **Twenty-second Midwest Differential Equations Conference**, University of Missouri, Columbia, MO. (Jul./Aug. 1993, p. 709)

13. **New York Graph Theory Day Twenty-six**, Bard College, NY. (Sep. 1993, p. 922)

15-17. **Representation Theory of Finite Groups and Algebras**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)

15-19. **IMA Workshop on Random Discrete Structures**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 63)

15-19. **Systèmes d'Équations Algébriques**, CIRM, Marseille, France. (Jan. 1993, p. 63)

15-19. **Supercomputing '93**, Portland, Oregon. (May/Jun. 1993, p. 513)

17-19. **European Symposium on Numerical Methods in Electromagnetics**, Toulouse, France. (Jul./Aug. 1993, p. 709)

17-19. **Research on Algebraic Combinatorics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 709)

18-21. **Nineteenth Annual Conference of the American Mathematical Association of Two Year Colleges (AMATYC)**, Boston, MA. (Sep. 1993, p. 923)

21-27. **Mathematische Modelle in der Biologie**, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)

22-26. **Géométrie Symplectique et Physique Mathématique**, CIRM, Marseille, France. (Jan. 1993, p. 63)

22-26. **Algebraic Combinatorics**, Kyushu University, Fukuoka, Japan. (Sep. 1993, p. 923)

22-27. **Géométrie Symplectique**, Marseille, France. (Feb. 1993, p. 187)

24-26. **Theory and Applications in Computer Algebra**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

28-December 4. **Nonlinear Equations in Many-Particle Systems**, Oberwolfach, Federal Republic of Germany. (Mar. 1992, p. 251)

## December 1993

1-3. **Linear Operators and Inequalities**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

1-4. **Joint Meeting with the Sociedad Matematica Mexicana**, Merida, Yucatan, Mexico.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

\*2-5. **First Belgian-French Meeting on PDE**, Han-sur-Lesse, Belgium. (Note additional invited speakers from Sep. 1993, p. 923)

INVITED SPEAKERS: Added speakers: P. Laubin (Liege), V.P. Maslov (Moscow), I. Naumkin (Moscow), P. Shishmarev (Moscow), V. Solonnikov (St. Petersburg).

5-9. **1993 International Symposium on Non-linear Theory and its Applications (NOLTA '93)**, Hawaii. (Apr. 1993, p. 414)

5-11. **Dynamical Zeta Functions**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

5-11. **Model Selection**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

6-10. **International Congress on Modelling Simulation, 1993**, University of Western Australia, Perth. (Feb. 1993, p. 187)

8-10. **Mathematical Structure of Optimization Theory**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

8-11. **International Conference on Vistas in Modern Applied Mathematics**, Goa University, Goa, India. (Jul./Aug. 1993, p. 710)

12-18. **General Principles of Discretization Algorithms, Theory, and Applications**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

12-18. **Methoden und Verfahren der Mathematischen Physik**, Oberwolfach, Federal Republic of Germany. (Feb. 1993, p. 187)

13-15. **Fourth IMA Conference on Cryptography and Coding**, Cirencester, UK. (Jul./Aug. 1993, p. 710)

13-17. **Statistics in Ecology and Environmental Monitoring**, Dunedin, New Zealand. (Sep. 1993, p. 923)

15-17. **Groups and Related Topics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)

## January 1994

January-June 1994. **A Semester at CRM: Bifurcations and the Geometry of Vector Fields**, Université de Montréal. (Jan. 1993, p. 63)

2-5. **Third International Symposium on Artificial Intelligence and Mathematics**, Fort Lauderdale, FL. (Jul./Aug. 1993, p. 710)

2-8. **Modelltheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

3-14. **Joint Workshop on Computational Aspects of Geometric Group Theory I**, The Geometry Center of the University of Minnesota, Minneapolis, MN. (Sep. 1993, p. 924)

4-7. **International Symposium on Visco-Elastic Fluids**, Tobago (In the Republic of Trinidad and Tobago). (Feb. 1993, p. 187)

- 4-8. **International Conference on Harmonic Analysis and Operator Theory**, Caracas, Venezuela. (Jan. 1993, p. 64)
- 4-9. **An International Conference on Mathematical Analysis and Signal Processing**, Cairo University, Egypt. (Jul./Aug. 1993, p. 710)
- 5-7. **Semigroup Theory**, Hobart, Tasmania, Australia. (Feb. 1993, p. 187)
- 5-9. **Twentieth Holiday Mathematics Symposium**, New Mexico State University, Las Cruces, NM. (Sep. 1993, p. 924)
- 9-15. **Algebraic Combinatorics: Association Schemes and Representation Theory**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)
- 10-12. **Nonlinear Partial Differential Equations**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)
- 12-15. **Joint Mathematics Meetings**, Cincinnati, OH (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

- 16-22. **Gruppentheorie (Permutationsgruppen)**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 710)
- 17-19. **Structure and Statistical Law of Turbulence**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 710)
- 23-25. **Fifth Annual ACM-SIAM Symposium on Discrete Algorithms**, Arlington, VA. (May/Jun. 1993, p. 513)
- 23-29. **Singulare Integral- und Pseudo-Differential-Operatoren und Ihre Anwendungen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)
- 24-28. **IMA Workshop on Mathematical Population Genetics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)
- 24-28. **Complex Analysis on Hyperbolic 3-manifolds**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 711)
- 25-29. **Sixth Benin International Conference on Scientific Computing**, University of Benin City, Nigeria. (Sep. 1993, p. 924)
- 30-February 5. **Nichtstandardanalysis und Anwendungen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

## February 1994

- February 1994. **Workshop on Dynamical Disease**, Laurentian Mountains north of Montréal. (Jan. 1992, p. 64)
- 2-4. **IMACS Symposium on Mathematical Modelling**, Vienna, Austria. (Jul./Aug. 1993, p. 711)

- 6-12.  **$C^*$ -Algebras**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)
- 7-11. **Differential Geometry, Hamiltonian Systems, and Operator Theory**, University of the West Indies, Mona, Jamaica. (Jul./Aug. 1993, p. 711)
- 13-19. **Funktionentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)
- 18-23. **Section A (Mathematics) Sessions at the AAAS Annual Meeting**, San Francisco, CA. (Sep. 1993, p. 924)
- 20-26. **Harmonische Analyse und Darstellungstheorie Topologischer Gruppen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 27-March 5. **Mathematical Economics**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 28-March 4. **IMA Workshop on Stochastic Networks**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

## March 1994

- 6-12. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 7-11. **Twenty-fifth Southeastern International Conference on Combinatorics, Graph Theory, and Computing**, Florida Atlantic University, Boca Raton, FL. (Sep. 1993, p. 924)
- 7-25. **Workshop on Fluid Mechanics**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 711)
- \* 13-17. **The UAB-Georgia Tech International Conference on Differential Equations and Mathematical Physics**, Birmingham, AL.

INVITED SPEAKERS: S. Agmon, The Hebrew Univ. of Jerusalem; D. Christodoulou, Princeton U.; T. Ichinose, Kanazawa U.; E. Lieb, Princeton U.; B. Simon, California Institute of Technology; and J. P. Solovej, Princeton U.

INFORMATION: Organizing Committee, Dept. of Math., Univ. of Alabama at Birmingham, Birmingham, AL 35294; e-mail: confere@math.uab.edu; tel: 205-934-2154; fax: 205-934-9025.

- 13-19. **Elementare und Analytische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 17-19. **Seminar on Stochastic Processes 1994**, Texas A&M University, College Station, TX. (Sep. 1993, p. 925)
- 18-19. **Southeastern Section**, University of Kentucky, Lexington, Kentucky.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

- 20-26. **Regelungstheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 21-25. **IMA Period of Concentration: Stochastic Problems for Nonlinear Partial Differential Equations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (May/Jun. 1993, p. 513)
- 21-25. **Symplectic Geometry of Moduli Spaces**, CIRM, Marseille/Luminy. (Sep. 1993, p. 925)
- 22-24. **The Rhine Workshop on Computer Algebra**, Karlsruhe, Germany. (Sep. 1993, p. 925)
- \* 24-26. **Fourth Eugene Lukacs Symposium**, Bowling Green State University, Bowling Green, OH.

ORGANIZER: A. Skorokhod.

CONFERENCE TOPIC: Infinite dimensional randomly perturbed dynamical systems.

INVITED SPEAKERS: *Tentative*: R. Dalang, F. Flandoli, J. Jacod, R. Khasminskii, N. Krylov, R. Mikulevicius, V. Mandrekar, D. Nualhart, E. Pardoux, B. Rozovskii, H. Salehi, A. Wentzell, R. Carmona, M. Csorgo, A. Kagan, E. Dynkin, P. Chow, and J. Menaldi.

INFORMATION: V. Rohatgi, Dept. of Math. and Stats., Bowling Green State University, Bowling Green, OH 43403; tel: 419-372-7470; e-mail: vrohatg@andy.bgsu.edu.

- 25-26. **Central Section**, Kansas State University, Manhattan, KS.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

- 27-April 2. **Algebraische Gruppen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 27-April 2. **Endliche Modelltheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 28-30. **Moduli Spaces, Galois Representations, and L-functions**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 711)
- 28-31. **Twenty-fifth Annual Iranian Mathematics Conference**, Sharif University of Technology, Tehran, Iran. (Jul./Aug. 1993, p. 711)
- 31-April 2. **Mathematical Approaches to the Study of Nonlinear Materials**, Fayetteville, Arkansas. (Sep. 1993, p. 925)

## April 1994

- 3-9. **Arbeitsgemeinschaft Mit Aktuellem Thema (wird in den Mitteilungen der DMV Heft 1/1994 Bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)
- 5-9. **MEGA-94, The Third International Symposium on Effective Methods in**

**Algebraic Geometry**, Santander, Spain. (Jul./Aug. 1993, p. 711)

5-11. **Effective Methods in Algebraic Geometry (MEGA '93)**, Santander, Spain. (Mar. 1993, p. 286)

5-15. **Instructional Conference on Harmonic Analysis and Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 711)

8-9. **Mathematical Breakthroughs in the Twentieth Century**, The State University of New York at Farmingdale, NY. (Jul./Aug. 1993, p. 712)

9-10. **Eastern Section**, Polytechnic University, Brooklyn, NY.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

10-16. **Numerical Linear Algebra with Applications**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

17-22. **International Conference on New Trends in Computer Science I (NETCOMS I)**, University of Ibadan, Nigeria. (Please note date change from Nov. 1992, p. 1121)

17-23. **Designs and Codes**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

18-20. **Conference on Emerging Issues in Mathematics and Computation from the Materials Sciences**, Pittsburgh, PA. (Sep. 1993, p. 925)

24-30. **Geschichte der Mathematik**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

25-29. **Third International Conference on p-adic Functional Analysis**, Clermont-Ferrand, France. (Sep. 1993, p. 925)

## May 1994

1-7. **Gruppentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

1-7. **Linear Operators and Application**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 712)

2-6. **IMA Workshop on Image Models (and Their Speech Model Cousins)**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

2-6. **International Conference on Topological Vector Spaces, Algebras, and Related Areas**, McMaster University, Hamilton, Ontario, Canada. (Mar. 1993, p. 286)

3-14. **The Fourth International School on Differential Equations: Bifurcations and Chaos**, Katsiveli, Crimea, Ukraine. (Sep. 1993, p. 926)

8-14. **Variationsrechnung**, Oberwolfach,

Federal Republic of Germany. (Mar. 1993, p. 286)

14-18. **International Congress Henri Poincaré**, Archives-Centre d'Etudes et de Recherche Henri-Poincaré, Nancy, France. (Jul./Aug. 1993, p. 712)

15-21. **Critical Phenomena in Spatial Stochastic Models**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

16-20. **IMA Workshop on Stochastic Models in Geosystems**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

16-20. **Géométrie Algébrique**, CIRM, Marseille, France. (Jan. 1993, p. 64)

16-27. **Workshop on Commutative Algebra and its Relation to Combinatorics and Computer Algebra**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 712)

22-24. **Conference in Honor of E. Dynkin**, MSI, Ithaca, NY. (Jul./Aug. 1993, p. 712)

22-27. **Nonlinear Analysis, Function Spaces, and Applications, V**, Prague, Czech Republic. (Sep. 1993, p. 926)

22-28. **Diskrete Geometrie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

23-25. **Twenty-sixth Symposium on Theory of Computing (STOC)**, Montreal, Canada. (Sep. 1993, p. 926)

24-27. **Conference on Hermann G. Graßmann (1809-1877)**, Isle of Rügen, Germany. (September 1992, p. 775)

24-28. **International Workshop on Mathematical Methods and Tools in Computer Simulation**, St. Petersburg State University, St. Petersburg, Russia. (Sep. 1993, p. 926)

25-28. **Second Conference on Function Spaces**, Southern Illinois University at Edwardsville, Illinois. (Sep. 1993, p. 926)

26-29. **ICANN '94-International Conference on Artificial Neural Networks**, Sorrento Congress Center, near Naples, Italy. (Jul./Aug. 1993, p. 712)

29-June 3. **International Conference on Real and Complex Algebraic Geometry**, Soesterberg, The Netherlands. (Jul./Aug. 1993, p. 712)

29-June 4. **Singuläre Störungsrechnung**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

29-June 4. **Workshop on Harmonic Analysis, Oscillatory Integrals, and Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 713)

30-June 3. **On the Interaction between Functional Analysis, Harmonic Analysis, and Probability**, University of Missouri-Columbia, Columbia, MO. (Jul./Aug. 1993, p. 713)

30-June 9. **Workshop on Group Represen-**

**tation Theory**, Technion, Israel Institute of Technology, Haifa, Israel. (Dec. 1992, p. 1284)

31-June 3. **IMA Minisymposium on Phase Transitions in Catalytic Surface Reaction Models**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

## June 1994

1-7. **1994 Barcelona Conference on Algebraic Topology**, Sant Feliu de Guixols (near Barcelona, Spain). (Jan. 1993, p. 64)

5-11. **The Navier-Stokes Equations: Theory and Numerical Methods**, Oberwolfach, Germany. (Jul./Aug. 1993, p. 713)

12-18. **Nichtlinearitäten vom Hysterestyp**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

13-17. **Fifth International Conference on Hyperbolic Problems: Theory, Numerical Methods, and Applications**, Stony Brook, NY. (May/Jun. 1992, p. 497)

13-17. **European Conference on Elliptic and Parabolic Problems**, Pont-à-Mousson, France. (May/Jun. 1993, p. 514)

Summer 1994. **Summer Regional Centers-TRANSIT**, Ohio State University, Columbus, OH. (Oct. 1992, p. 951)

13-17. **IMA Workshop on Classical & Modern Branching Processes**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

15-18. **Fifth SIAM Conference on Applied Linear Algebra**, Snowbird, Utah. (Sep. 1993, p. 927)

16-18. **Western Section**, University of Oregon, Eugene, Oregon.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

19-25. **Quantenmechanik von Vielteilchen Systemen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

19-25. **Integrable Systems from a Quantum Point of View**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

20-24. **Probabilités Quantiques**, CIRM, Marseille, France. (Jan. 1993, p. 64)

20-24. **IMA Workshop on Mathematics in Manufacturing Logistics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Sep. 1993, p. 927)

22-25. **Seventh SIAM Conference on Discrete Mathematics**, Albuquerque, NM. (Sep. 1993, p. 927)

25-July 2. **Symposium on Diophantine Problems in Honor of Wolfgang Schmidt's 60th Birthday**, Boulder, Colorado. (May/Jun. 1993, p. 514)



26-July 2. **Graphentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

26-July 2. **Inverse Problems**, Lake St. Wolfgang, Austria. (May/Jun. 1993, p. 514)

## July 1994

2-8. **Fourth Conference of the Canadian Number Theory Association**, Dalhousie University, Halifax, Nova Scotia, Canada. (Sep. 1993, p. 927)

3-9. **Analysis und Geometrie Singulärer Räume**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

\*4-7. **Ninth Annual IEEE Symposium on Logic in Computer Science**, Paris, France.

PROGRAM: This symposium aims to attract high quality original papers covering theoretical and practical issues in computer science that relate to logic in a broad sense, including algebraic, categorical, and topological approaches.

CONFERENCE TOPICS: Abstract data types, automated deduction, concurrency, constructive mathematics, data base theory, finite model theory, knowledge representation, lambda and combinatory calculi, logical aspects of computational complexity, logics in artificial intelligence, logic programming, modal and temporal logics, program logic and semantics, rewrite rules, logical aspects of symbolic computing, problem solving environments, software specification, type systems, and verification.

CALL FOR PAPERS: Submission deadline: December 13, 1993. Ten hard copies of a detailed abstract (not a full paper) and twenty additional copies of the cover page should be received by December 13, 1993, by the program chair.

INFORMATION: **General chair**, R.L. Constable, Dept. of Comp. Sci., Upson Hall, Cornell U., Ithaca, NY 14853; e-mail: rc@cs.cornell.edu.

**Program chair**, S. Abramsky, Dept. of Comp., Imperial College of Science, Technology, and Medicine, 180 Queen's Gate, London SW7 2BZ; sa@doc.ic.ac.uk; tel: (44)71-589-5111; fax: (44)71-581-8024.

**Conference co-chairs**, G. Huet, INRIA Rocquencourt, B.P. 105-78153, Le Chesnay Cedex, France; huet@margaux.inria.fr; J.-P. Jouannaud, CNRS and LRI, Bat. 490, Univ. de Paris Sud, 91405 Orsay Cedex, France; jouannaud@margaux.inria.fr.

4-8. **International Conference on Computer Aided Geometric Design (CAGD)**, Penang, Malaysia. (Jul./Aug. 1993, p. 713)

\*4-8. **Thirty-eighth Annual Meeting of the Australian Mathematical Society**, University of New England in Armidale, Australia.

ORGANIZING COMMITTEE: R. Bartnik, I. Bokor, Y. Du, J. Hempel, and C. Radford. INVITED SPEAKERS: A. Baernstein, A. Beardon, P.J. Hilton, C. Kenig, R. Schoen, E. Zelmanov.

INFORMATION: 38th Annual Meeting of the Australian Mathematical Society, Dept. of Math., Stats., and Comp. Sci., The University of New England, Armidale 2351, Australia; ams94@neumann.une.edu.au.

5-9. **Twenty-fourth National Conference on Geometry and Topology (CNGT 24)**, University of Timișoara, Romania. (Jul./Aug. 1993, p. 713)

5-29. **IMA Summer Program on Molecular Biology**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1993, p. 415)

10-16. **Freie Randwertprobleme**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

11-15. **Fourteenth IMACS World Congress on Computational and Applied Mathematics**, Georgia Institute of Technology, Atlanta, GA. (Oct. 1992, p. 951)

14-18. **LFCS'94: Logic at St. Petersburg, a Symposium on Logical Foundations of Computer Science**, St. Petersburg, Russia. (Jul./Aug. 1993, p. 714)

17-23. **Conférence Internationale de Topologie**, CIRM, Marseille, France. (Jan. 1993, p. 64)

17-23. **Algebraische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

17-23. **Workshop on Harmonic Analysis and Elliptic Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 714)

18-22. **Sixth International Conference on Fibonacci Numbers and Their Applications**, Washington State University, Pullman, WA. (Jul./Aug. 1993, p. 714)

\*18-29. **Fifth Workshop of Stochastic Analysis of Oslo-Silivri**, Silivri, Istanbul, Turkey.

ORGANIZING COMMITTEE: H. Körezlioglu, B. Oksendal, A.S. Üstünel.

PROGRAM: The first week will be devoted to three main lectures in (1) theory of capacity on the Wiener space, by F. Hirsch (France); (2) an introduction to recent developments in financial mathematics, by D. Duffie (U.S.); (3) the mathematical theory of communication networks, by V. Anantharam (U.S.). The second week will be devoted to contributed papers.

INFORMATION: H. Körezlioglu or A.S. Üstünel, ENST, Dept. Reseaux, 46, rue Barault, 75634 Paris Cedex 13, France; fax: 33-1-45891664; korez@res.enst.fr or ustunel@res.enst.fr; or B. Oksendal or T. Lindstrom, Dept. of Math., Univ.

of Oslo, Box 1053 Blindern, N-0316 Oslo, Norway; fax: 47-22854349; e-mail: oksendal@math.uio.no or lindstro@math.uio.no.

20-30. **Third Souslin Conference**, Saratov, Russia. (Jul./Aug. 1993, p. 714)

24-30. **Complex Geometry: Moduli Problems**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

25-29. **Représentation des Groupes Reductifs  $p$ -adiques**, CIRM, Marseille, France. (Nov. 1992, p. 1122)

25-29. **1994 SIAM Annual Meeting**, San Diego, CA. (Sep. 1993, p. 927)

31-August 6. **Mechanics of Materials**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

## August 1994

1-5. **Third World Congress on Computational Mechanics (WCCM III)**, Chiba, Japan. (May/Jun. 1992, p. 497)

3-11. **The International Congress of Mathematicians 1994**, Zürich, Switzerland. (Jul./Aug. 1993, p. 714)

7-13. **Effiziente Algorithmen**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

\*12-20. **1994 Summer Workshop-Conference on Classical and Quantum Geometry of Homogeneous Spaces**, International Sophus Lie Centre, Moscow.

PROGRAM: The workshop aspect of the meeting will include plenary lectures (accessible to graduate students) and consultations in problem-solving. The plenary lectures will be given by leading personalities in the field. The conference aspect will consist of more specialized seminars where experts will report on current results.

CONFERENCE TOPICS: Lie groups and homogeneous spaces, symmetries of differential equations, quantum groups and homogeneous spaces.

INFORMATION: B. Komrakov, ISLC, Dept. of Math., Univ. of Oslo, P.O. Box 1053, Blindern, N-0316, Oslo, Norway; e-mail: islc@math.uio.no; fax: (02) 22 85 58 88.

13-17. **Third Colloquium on Numerical Analysis**, Plovdiv, Bulgaria. (Apr. 1993, p. 416)

14-20. **Nonlinear Evolution Equations**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

15-17. **Mathfest**, University of Minnesota, Minneapolis, MN (including the summer meetings of the AMS, AWM, MAA, and PME).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

15-19. **Fifteenth International Symposium on Mathematical Programming**, University of Michigan, Ann Arbor, MI. (May/Jun. 1993, p. 515)

15-26. **Advanced Workshop on Algebraic Geometry**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 714)

16-20. **ICMI-China Regional Conference on Mathematics Education**, Shanghai, China. (Jul./Aug. 1993, p. 714)

18-23. **Fifth Colloquium on Differential Equations**, Plovdiv, Bulgaria. (Apr. 1993, p. 416)

20-26. **International Conference on Rings and Radicals**, Shijiazhuang, China. (Mar. 1993, p. 287)

21-27. **Mathematical Models in Phase Transitions**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

22-26. **Sixth Conference on Numerical Methods in Hungary**, Miskolc University, Miskolc, Hungary. (Sep. 1993, p. 928)

28-September 3. **Komplexe Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

## September 1994

\* September 1994. **Suslin Jubilee International Conferences**, Suslin Foundation, Russia.

PROGRAM: A cycle of international scientific conferences on Suslin's areas of interest is to be held in September 1994 as part of the Suslin Jubilee, marking the centenary of Suslin's birth.

INFORMATION: V. Molchanov, Executive Director of the Suslin Foundation, Faculty of Mathematical Studies, The Pedagogical Institute, ul. Michurina 92, Saratov, Russia.

4-10. **Topologie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

\* 6-8. **International Conference on Parallel Processing: CONPAR 94-VAPP VI**, Linz, Austria.

CALL FOR PAPERS: Submissions of papers presenting original research in parallel processing including the following areas: languages/software tools, hardware/architecture, algorithms, models/semantics, testing and debugging, automatic parallelization and mapping, performance analysis, applications, paradigms for concurrency, and portability. A special session will be organized on parallel symbolic computation.

INFORMATION: A. Spalt, Univ. of Linz, Altenbergerstr. 69, A-4040 Linz, Austria, Europe; tel: ++43-(0) 732-2468-887(885); fax: ++42-(0)732-2468-10; conpar94@gup.uni-linz.ac.at.

11-17. **Homotopietheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

15-19. **Fifteenth International Symposium on Mathematical Programming**, University of Michigan, Ann Arbor, MI. (Apr. 1993, p. 416)

18-20. **Teaching of Mathematics for Industry**, Prague. (Jul./Aug. 1993, p. 715)

18-24. **Risk Theory**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

19-23. **3ème Atelier International de Théorie des Ensembles**, CIRM, Marseille, France. (Apr. 1993, p. 416)

\* 21-23. **Meeting on Matrix Analysis and Its Applications**, Vitoria-Gasteiz, Spain.

PROGRAM: The conference will feature seven invited 45- to 60-minute lectures. There will also be sessions for 15- to 20-minute contributed papers.

INVITED SPEAKERS: R. Canto, J. Ferrer, N.J. Higham, I. Perez Arriaga. *Tentative*: N. Bebiano, F.C. Silva, G.P.A. Thijsse.

INFORMATION: J.M. Garcia, Dept. Matemática Aplicada y Estadística e I. O., Universidad del País Vasco, Apartado 450, E-01080, Vitoria-Gasteiz, Spain; fax: 34-45-130756; e-mail: mepgmej@lg.ehu.es.

25-October 1. **Mathematical Methods in Tomography**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

\* 26-October 1. **First International Workshop on Functional Analysis**, Trier University, near Luxembourg, Germany.

ORGANIZING COMMITTEE: S. Dierolf, L. Frerick, H. Hüser, K. Aye Aye, S. Müller, J. Wengenroth.

INFORMATION: FB IV-Mathematik, Universität Trier, D-54286 Trier, Germany; tel: 0651/201/3511; fax: 0651/201/3935; e-mail: dierolf@uni-trier.dpe.de.

## October 1994

2-8. **Randelementmethoden: Anwendungen und Fehleranalysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

9-15. **Arbeitsgemeinschaft mit Aktuellem Thema (Wird in den Mitteilungen der DMV Heft 3/1994 Bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

10-28. **School/Workshop on Variational and Local Methods in the Study of Hamiltonian Systems**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 715)

16-22. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

23-29. **Wahrscheinlichkeitsmaße auf Gruppen und Verwandten Strukturen**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

28-29. **Central Section**, Oklahoma State University, Stillwater, Oklahoma.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

30-November 5. **Finite Volume Methods**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

## November 1994

11-13. **Southeastern Section**, University of Richmond, Richmond, VA.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

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)

20-26. **Mathematical Aspects of Computational Fluid Dynamics**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

27-December 3. **Mathematical Models for Infectious Diseases**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

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.

## December 1994

4-10. **Applied Probability**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

12-14. **SIAM Conference on Inverse Problems**, Fish Camp, CA, *tentative*. (Sep. 1993, p. 928)

18-23. **Asymptotik Hochdimensionaler Statistischer Modelle**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

## 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

4-7. **Joint Mathematics Meetings**, San Francisco, CA (including the annual meetings of the AMS, AWM, MAA, and NAM).

## Meetings and Conferences

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

### March 1995

4-5. **Eastern Section**, Hartford, Connecticut.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

17-18. **Southeastern Section**, Orlando, Florida.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

24-25. **Central Section**, DePaul University, Chicago, IL.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

### May 1995

11-13. **First International Conference on Nonlinear Problems in Aviation and Aerospace 1995**, Embry-Riddle Aeronautical University, Daytona Beach, FL. (Sep. 1993, p. 928)

### November 1995

3-4. **Central Section**, Kent State University, Kent, Ohio.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

### 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.

### March 1996

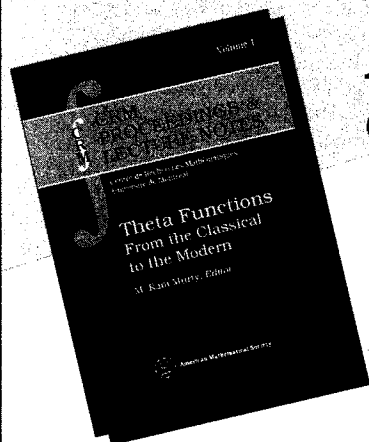
22-23. **Central Section**, University of Iowa, Iowa City, Iowa.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

### April 1996

19-21. **Southeastern Section**, Baton Rouge, Louisiana.

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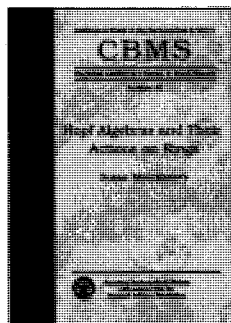
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now have connections to many areas of mathematics. In addition, several conjectures of Kaplansky have been solved, the most striking of which is a kind of Lagrange's theorem for Hopf algebras. Work on actions of Hopf algebras has unified earlier results on group actions, actions of Lie algebras, and graded algebras. This book brings together many of these recent developments from the viewpoint of the algebraic structure of Hopf algebras and their actions and coactions. Quantum groups are treated as an important example, rather than as an end in themselves. The two introductory chapters review definitions and basic facts; otherwise, most of the material has not previously been published. Providing an accessible introduction to Hopf algebras, this book would make an excellent graduate textbook for a course in Hopf algebras or an introduction to quantum groups.

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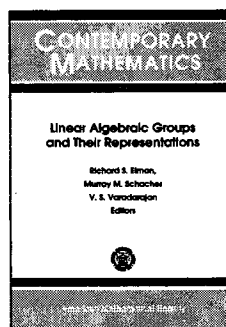
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Richard S. Elman,  
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V. S. Varadarajan, Editors  
Volume 153

This book contains the proceedings of the Conference on Linear Algebraic Groups and Their Representations, held at UCLA in March 1992. The central theme is the fundamental nature of this subject and its

interaction with a wide variety of active areas in mathematics and physics. Linear algebraic groups and their representations interface with a broad range of areas through diverse avenues—with algebraic geometry through moduli spaces, with classical invariant theory through group actions on polynomial rings, with enumerative and combinatorial geometry through flag manifolds, and with theoretical physics through Kac-Moody algebras and quantum groups. Collected here are both surveys and original contributions by eminent specialists, reflecting current developments in the subject. This book is one of the few available sources that brings together such a wide variety of themes under a single unifying perspective.

#### Contents

*W. Feit, Extending Steinberg characters; I. Grojnowski and G. Lusztig, A comparison of bases of quantized enveloping algebras; R. M. Guralnick and A. Weiss, Transitive permutation lattices in the same genus and embeddings of groups; W. Haboush and N. Lauritzen, Varieties of unseparated flags; V. Lakshmibai, Bases for Demazure modules for symmetrizable Kac-Moody algebras; K. C. Misra, Representations of quantum affine Lie algebras and crystal bases; M. S. Raghunathan and T. N. Venkataramana, The first Betti number of arithmetic groups and the congruence subgroup problem; R. W. Richardson and T. A. Springer, Combinatorics and geometry of  $K$ -orbits on the flag manifold; G. E. Röhrle, On extraspecial parabolic subgroups; G. M. Seitz, Bounds for dimensions of weight spaces of maximal tori; C. S. Seshadri, Vector bundles on curves.*

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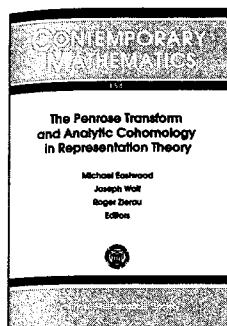
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## The Penrose Transform and Analytic Cohomology in Representation Theory

Michael Eastwood, Joseph Wolf, and Roger Zierau, Editors

Volume 154

This book contains refereed papers presented at the AMS-IMS-SIAM Summer Research Conference on the Penrose

Transform and Analytic Cohomology in Representation Theory held in the summer of 1992 at Mount Holyoke College. The conference brought together some of the top experts in representation theory and differential geometry. One of the issues explored at the conference was the fact that various integral transforms from representation theory, complex integral geometry, and mathematical physics appear to be instances of the same general construction, which is sometimes called the "Penrose transform". There is considerable scope for further research in this area, and this book serves as an excellent introduction.

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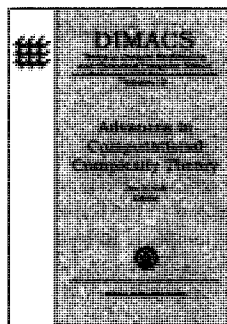
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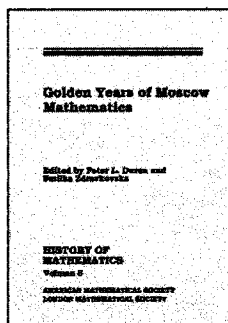
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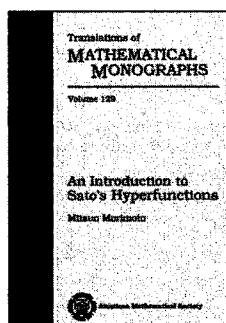
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Mitsuo Morimoto  
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to such areas as pseudodifferential operators and S-matrices. Assuming as little background as possible on the part of the reader, Morimoto covers the basic notions of the theory, from hyperfunctions of one variable to Sato's fundamental theorem. This book provides an excellent introduction to this important field of research.

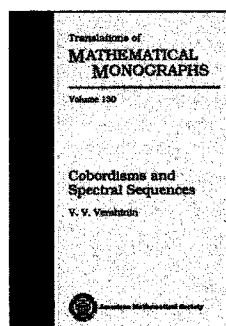
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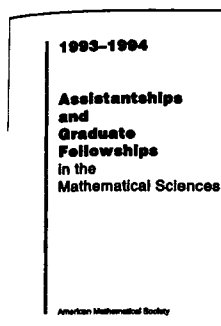
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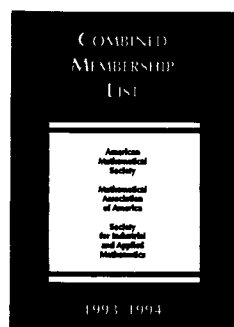
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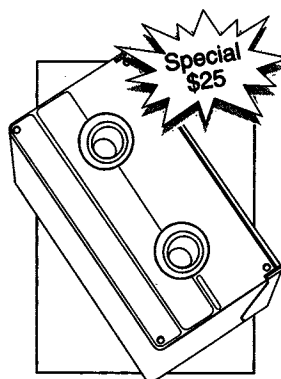
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Kenneth A. Ribet

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announced his proof of this celebrated theorem. Wiles's main result, a special case of the Taniyama Conjecture, relies on a wide range of mathematical tools developed over the past ten years. A crucial link was a 1986 theorem that the Taniyama Conjecture implies Fermat's Last Theorem, proved by Kenneth Ribet, who gives the two lectures on this videotape. Presented just weeks after Wiles's now-historic announcement, these expository lectures describe the main ingredients in Wiles's results. The lectures would be accessible to advanced undergraduates and graduate students with some background in algebra and number theory.

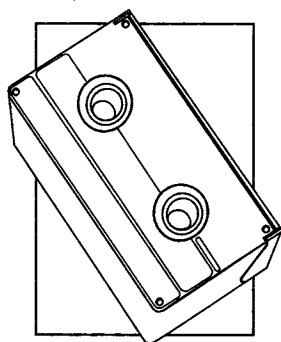
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Shiing S. Chern

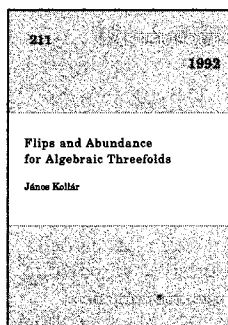
This videotape captures a lecture by one of the legendary figures of modern mathematics, Shiing S. Chern, who brings a masterly touch and profound intuition to the subject of characteristic forms. Starting with the notion of Stiefel-Whitney classes, he moves on to the case of a complex vector bundle and the definition of a characteristic form. These concepts

lead to the definition of the celebrated Chern-Simons forms and a certain global conformal invariant that has proven to be extremely useful in physics. Chern also discusses the related  $\eta$ -invariant of Atiyah, Patodi, and Singer. Touching on the uses of these kinds of ideas in quantum field theory and other areas of physics, Chern makes some predictions about fruitful directions for future research in geometry. The lecture is accessible to advanced undergraduates and graduate students having a good grasp of the fundamentals of differential geometry and algebraic topology.

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 for Algebraic Threefolds**  
 János Kollár  
 Number 211

This book contains twenty-three lectures which comprised a summer seminar in three-dimensional algebraic geometry held in August 1991 at the University of Utah. The aim of the seminar was to explore and simplify recent developments in the theory of algebraic threefolds. The study

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Joel Friedman, Editor  
 Volume 10

This volume contains the proceedings of the DIMACS Workshop on Expander Graphs, held at Princeton University in May 1992. The subject of expanding graphs involves a number of different fields and gives rise to important connections among them. Many of these fields were represented at the workshop, including theoretical computer science, combinatorics, probability theory, representation theory, number theory, and differential geometry. With twenty-two talks and two open problem sessions, the workshop provided a unique opportunity for cross-fertilization of various areas. This volume will prove useful to mathematicians and computer scientists interested in current results in this area of research.

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## Miscellaneous

### Personals

**Edward F. Assmus, Jr.**, of Lehigh University, has been appointed University Distinguished Professor of Mathematics at that institution.

**Mostafa Ghandehari**, a visiting scholar at the University of California, Davis, will retire effective January 1, 1994.

**Aloysius Bathi Kasturiarachi**, of Duke University, won first prize at the SIAM-SEAS annual meeting held at Georgia Southern University for his paper, "Nondissipative Shock Waves for Generalized Korteweg-de Vries Equation," and was the recipient of the 1992 J. Burton Linker Award for excellence in teaching by a mathematics graduate student.

**Florence J. Lin**, of the University of California at Berkeley, has been appointed a Science Scholar at The Mary Ingraham Bunting Institute of Radcliffe College for 1993–1994.

**Lee Lorch** was awarded the degree of Doctor of Laws, *honoris causa*, by York University on June 15, 1993. Professor Lorch has been with York since 1968 where he is now a Professor Emeritus and Senior Scholar. In addition to an outstanding mathematical career, Professor Lorch has been a lifelong advocate of civil rights and has fostered the participation of women and visible minorities in mathematics. Recently, he has been honored by the Association for

Women in Mathematics and has received a special award by Howard University for his contributions to civil rights and the education of Black mathematicians.

**Lauren L. Rose**, of Wellesley College, has been appointed a Science Scholar at The Mary Ingraham Bunting Institute of Radcliffe College for 1993–1994.

**Patricia L. Sipe**, of Smith College, has been appointed a Fellow at The Mary Ingraham Bunting Institute of Radcliffe College for 1993–1994.

### Deaths

**Harold M. Bacon**, Professor Emeritus of Stanford University, died on August 22, 1992. He was born on January 13, 1907, and was a member of the Society for 62 years.

**Joseph E. D'Atri**, of Rutgers University, died on April 29, 1993. He was born on April 20, 1938, and was a member of the Society for 33 years.

**Edgar D. Eaves**, Professor Emeritus of the University of Tennessee, died on December 2, 1992. He was born in May 1904 and was a member of the Society for 55 years.

**Guy C. Hirsch**, Professor Emeritus of the University of Brussels, died on August 4, 1993. He was born on September 20, 1915, and was a member of the Society for 35 years.

**John H. P. Maecher**, of Miami, Florida, died on November 27, 1992. He

was born on July 6, 1929, and was a member of the Society for 39 years.

**Edward B. Roessler**, Professor Emeritus of the University of California, Davis, died on July 12, 1993. He was born in August 1902 and was a member of the Society for 63 years.

### Visiting Mathematicians

#### Supplementary List

Mathematicians visiting other institutions during the 1993–1994 academic year have been listed in recent issues of the *Notices*: July/August 1993, p. 731, and September 1993, p. 947.

**Richard Darling** (U.S.A.), University of Aarhus, Denmark, 9/93–10/93; University of Provence, France, 11/93–2/94, Probability.

**A. Krasil'nikov** (Russia), University of Manitoba, Group Theory, 9/93–10/93.

**Y. Kuz'min** (Russia), University of Manitoba, Group Theory, 9/93–10/93.

**Jens-Peter Lynov** (Denmark), University of New Mexico, Applied Mathematics, 8/93–7/94.

**V. Romankkov** (Russia), University of Manitoba, Group Theory, 11/93–12/93.

**N. S. Romanowskii** (Russia), University of Manitoba, Group Theory, 10/93–11/93.

**Kazuyuki Tsurumi** (Japan), University of Victoria, Complex Analysis, 8/93–8/94.

# New Members of the AMS

## ORDINARY MEMBERS

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Egypt  
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### Minimal Surfaces

A. T. Fomenko, Editor  
Volume 15

This book contains recent results from a group focusing on minimal surfaces in the Moscow State University seminar on modern geometrical methods, headed by A. V. Bolsinov, A. T. Fomenko, and V. V. Trofimov. The papers collected here fall into three areas: one-dimensional minimal graphs on Riemannian surfaces and the Steiner problem, two-dimensional minimal surfaces and surfaces of constant mean curvature in three-dimensional Euclidean space, and multidimensional globally minimal and harmonic surfaces in Riemannian manifolds. Prepared with attention to clarity and accessibility, these papers will appeal to mathematicians, physicists, and other researchers interested in the application of geometrical methods to specific problems.

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## Stipends for Study and Travel

Items marked with a • are repeated from the October 1992 issue with only a change in the year; the resulting announcement has not yet been confirmed by the sponsoring agent.

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**American Association of University Women (AAUW) Educational Foundation. American Fellowships.** Postdoctoral and dissertation 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 \$13,500, 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, 1111 16th Street, NW, Washington, DC 20036; telephone: 202-728-7603.

**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 re-enter 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 non-traditional 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 pre-requisites 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, 1994. 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 two-fold. 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 and/or science or interdisciplinary approach to subjects; have at least five 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 period of study undertaken. 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, 1111 16th Street, NW, Washington, DC 20036; telephone: 202-728-7603.

**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 Profession Fellowships, 1111 16th Street, NW, Washington, DC 20036; telephone: 202-728-7603.

- **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, 1994. 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 (AWU).** AWU is a contractor for 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, Utah 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 of \$2,000 or \$4,000 as well as room and board for the academic year in the Bunting-Cobb Math, Science, and Engineering Hall. 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, California 94245-0621. The application deadline for 1994-1995 awards is March 2, 1994.

**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, Virginia 22302-0268.

**Committee on Institutional Cooperation.** *CIC Predoctoral Fellowships in the Natural Sciences, Mathematics, and Engineering.* Fellowships are offered to African Americans, American Indians, 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 \$10,000 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, Indiana University, University of Iowa, University of Michigan, 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. The deadline for applications for the 1994-1995 academic year is December 1, 1993. Applications and further information may be obtained from the CIC Predoctoral Fellowships Program, Kirkwood Hall, Room 111, Indiana University, Bloomington, Indiana 47405. From outside Indiana call toll-free 1-800-457-4420. In Indiana call 812-855-0823.

**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, and 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 March 1, 1994. Women and minorities are encouraged to apply. Funding can begin between August 1, 1994, and January 1, 1995. For information and application materials contact: Program in Mathematics and Molecular Biology, 103 Donner Laboratory, University of California, Berkeley, CA 94720; e-mail: sylviaj@violet.berkeley.edu; fax: 510-642-4071.

**Florida Endowment 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 Endowment 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 Endowment Fund for Higher Education, 201 E. Kennedy Boulevard, Suite #1525, Tampa, FL 33602; 813-272-2772. The deadline for applications for Fall 1994 is January 15, 1994.

**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 1994 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 1993. Students interested in the 1994 predoctoral and dissertation fellowship 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, Georgia 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, New Jersey 08544.

**Fannie and John Hertz Foundation Fellowships.** The stipend is \$16,000, plus \$8,000-\$10,000 cost-of-education allowance 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 22, 1993. Applicants should write to the Office of the Graduate Dean at these institutions, or write directly to the Hertz Foundation, Box 5032, Livermore, California 94551-5032.

**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, California 90080-0028.

**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.

• **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, 1994. For information write to Scholarship and Exchange Programs, the Kosciuszko Foundation, 15 East 65th Street, New York, New

York 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, Tennessee 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 less than twenty semester hours or thirty quarter hours of graduate study in science or engineering. Stipends of \$14,000 proposed for 1994–1995 for a 12-month tenure. No dependency allowances. Education allowance paid to fellowship institution. Application deadline is early November. Further information and application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418; 202-334-2872.

**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). The stipend is \$14,000 proposed for 1994–1995 for 12-month tenures. No dependency allowances. Education allowance paid to fellowship institution. The deadline for applications is early November. Application materials may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418; 202-334-2872.

• **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 1994 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, 1993. 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, Black and Other Ethnic Minority Doctoral Fellowships, and Teaching Fellowships.* *Andrews Fellowships:* The stipend is \$14,000 for twelve months with tuition and fees remitted except for \$221 per semester and \$110.50 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. *Minority Fellowships:* The stipend is \$14,000 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 \$221 per semester and \$110.50 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: geomm@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), 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., 111 East Wacker Dr., Suite 200, Chicago, IL 60601-4298.
- **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 re-

searchers, 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. Peter A. Lachenbruch, 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. Forty \$6,000 grants to women for graduate study in aerospace-related science or engineering are awarded annually. Qualifications for the Fellowships are: A graduate degree preparatory for advanced study and research in a qualifying area of science or engineering; a superior academic record and evidence of potential; and an acceptance by an institution offering fully accredited graduate courses and degrees in aerospace-related sciences and engineering. Deadline for applications is December 1. Applications available after August. 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 through their organizations for research support. 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, neural computation systems, and electromagnetics. Research proposals should be forwarded to the Director of Mathematical and Computer Sciences, 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.** *1994-1995 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 1994. 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 mid-career 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, 1994. 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 assessing the significance of long-range environmental problems and opportunities. Prospective fellows must be postdoctoral to mid-career 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 \$1000 per week plus nominal relocation and travel expenses. The deadline for receipt of applications is January 15, 1994. 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, 1982, and December 31, 1987, 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 1994-1995 has been set by the Trustees of the Society at \$42,600 for nine months. In addition, there will be an expense allowance of \$1,400. 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 several years. The deadline for receipt of applications is **December 1, 1993.** 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](mailto: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, Pennsylvania 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 14, 1994. For published announcement write to NASA-ASEE Summer Faculty Fellowships, American Society for Engineering Education, Suite 200, Eleven Dupont Circle, NW, 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 at any time throughout the year. For information, write to: Navy-ASEE Faculty Research Programs Director, Eleven Dupont Circle, Suite 200, 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 14, 1994. For a program announcement write to Navy Summer Faculty Program, American Society for Engineering Education, Suite 200, Eleven Dupont Circle, NW, 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 1994-1995 academic year. The Fellowships are intended for senior researchers, while the Associateships are for advanced graduate students and recent Ph.D.s. 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 processing and measurement; on-line control in automated manufacturing; statistical computing, design, modeling, and simulation of measurement processes; design of experiments; graphical data analysis; 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 14, 1994, for Fellows and February 18, 1994, 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 \$31,300 plus up to \$3,000 in research expenses; one-year appointment; access to Harvard/Radcliffe libraries and facilities. Deadline for applications is October 15, 1993 (postmarked). Write or call for application and information to: Science Scholar Fellowship Program, The Bunting Institute of Radcliffe

College, 34 Concord Avenue, Cambridge, Massachusetts 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 1994–1995 is \$38,000. Duties include teaching one course for the full academic year. Please send applications by January 1 to Professor M. Aschbacher, Professor and Executive Officer for Mathematics, 253-37 Sloan Laboratory, Pasadena, California 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 1993–1994 was \$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, 1994, 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 1994–1995. 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 21, 1994. 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, New York 14853-7901.

**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 1994–1995 academic year are due by **December 15, 1993**. 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 \$34,000 is supplemented by a two-month resident research stipend of \$7,556, for a total of \$41,556. Appointments are for two years and are not renewable. Applicants should write to Department of Mathematics and Computer Science, Dartmouth College, Hanover, New Hampshire 03755 (Attention: Recruiting). Applicants are advised to apply promptly, and no later than January 15, 1994.

**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 1994. 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 multi-country 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 round-trip travel; maintenance allowance to cover living costs of grantee and family; and other supplemental allowances. 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 deadlines vary. 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.

- **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 \$26,000 in 1992. For more information write to John Simon Guggenheim Memorial Foundation, 90 Park Avenue, New York, New York 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 six hours per week of lectures including a half course on any 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, Massachusetts 02138. Applications must be filed by December 24, 1993. Harvard is an Equal Opportunity/Affirmative Action Employer, and particularly encourages applications from women and minority candidates.

**IBM Thomas J. Watson Research Center.** *Mathematical Sciences Department Postdoctoral Research Fellowship.* This fellowship provides an opportunity for scientists of outstanding ability to advance their scholarship as resident department members at the Research Center. The program of the Mathematical Sciences Department is organized for research in pure and applied mathematics, and in theoretical and exploratory computer science. The department provides an atmosphere in which basic research is combined with exposure to technical problems arising in industry. Work in the department is on-going in algorithms, computational complexity, coding numerical analysis, differential equations, mathematical optimization, logic design, computer algebra, statistics, dynamical systems, continuous complexity, computational linguistics, signal processing, user interface technology, and knowledge-based systems. Close interaction with permanent department members is expected, but fellows will be free to pursue their own research interests. Each candidate must have a doctorate and not more than five years of postdoctoral professional experience when the fellowship commences. The fellowships has a period of one year, and may be extended by another year on mutual agreement. The stipend will be generally in the range of \$63,000 to \$65,000 per year, depending on experience. In addition, there will be an allowance for moving expenses. The Research Center is located in Westchester County about forty miles north of New York City. To apply, submit the following by **January 15, 1994**: résumé, including thesis summary; thesis or reprints of publications based on thesis and other research; a research proposal; and visa status. Citizens of countries defined as restricted by the U.S. Department of Commerce are required to have a green card or an equivalent visa status. Applicants are responsible for requesting that three or more letters of reference, including one from the thesis advisor, **arrive before January 15**. Direct all material to Committee on Postdoctoral Fellowships, Department of Mathematical Sciences, IBM Research Division, T.J. Watson research Center, Post Office Box 218, Yorktown Heights, New York 10598. One fellowship will be awarded. Each applicants will be notified individually as soon as the Committee has reached a decision on the application.

**Indiana University, Bloomington.** *Václav Hlavatý Research Assistant Professorships.* This position is intended for mathematicians with recent doctorates who show definite promise in research and teaching. Inquiries and requests for application forms should be addressed to Recruitment Committee, Department of Mathematics, Indiana University, Bloomington, Indiana 47405. Preference will be given to applications received before January 1, 1994. Indiana University is an Equal Opportunity/Affirmative Action Employer.

**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 1994–1995. 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, New Jersey 08540, and should be returned (whether or not funds are expected from some other source) by December 1, 1993. 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, 1994. The postdoctoral terms will include the academic year program on Waves and Scattering, September 1994 to June 1995. All requirements for a doctorate should be completed by September 1, 1994. 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 Waves and Scattering 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 15, 1994. *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 S.E., Minneapolis, MN 55455-0436 U.S.A. The University of Minnesota is an equal opportunity educator and employer, and specifically invites and encourages applications from women and minorities.

**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, 1994. These appointments are in addition to the regular IMA 1994–1995 postdoctoral program in “Waves and Scattering” and are funded jointly by the NSF and by industry. They are designed to prepare mathematicians for research careers involving industrial interaction. Applicants should have received their Ph.D. in Mathematics or Applied Mathematics by September 1, 1994. 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 topics: (1) Signal processing and computational ocean acoustics; (2) Diffractive optics; Maxwell equations in periodic structure; (3) Computational fluid mechanics—viscous free-surface flows; (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 interest, 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 15, 1994. *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 S.E., Minneapolis, MN 55455-0436 U.S.A. The University of Minnesota is an equal opportunity educator and employer, and specifically invites and encourages applications from women and minorities.

**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, New Mexico 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, New Mexico 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, Massachusetts 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 1994–1995 applications is January 3, 1994, and awards will be made February 15, 1994. 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 yearlong research fellowships with starting date September 1994 for new and recent Ph.D.s. The stipend will be at least \$30,000. The year 1994–1995 features a yearlong program in Automorphic Forms and a half-year program in Complex Dynamics and Hyperbolic Geometry in the spring; 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, Berkeley, California 94720; 510-642-0143. Files must be complete by November 30, 1993. Please see page 550 of the May/June 1993 *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, 1991, and September 1, 1994. 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 1994. The initial stipend will be \$31,000. Completed applications are due October 12, 1993. Please send requests for application materials to Michigan Society of Fellows, 3030 Rackham Building, The University of Michigan, Ann Arbor, Michigan 48109-1070; 313-763-1259.

**Michigan State University.** *MSU Postdoctoral Research Positions in Mathematics.* One or more 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 1994, with a starting salary of at least \$34,000. Teaching duties will be kept to a minimum to maximize research time and interaction with faculty. The teaching load is three (3-credit) semester courses per year. 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@mth.msu.edu](mailto:hiring@mth.msu.edu). The deadline for applications is December 1, 1993. MSU is an Equal Opportunity/Affirmative Action Employer.

**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. Stipends are \$31,500 for recent recipients of the Ph.D. and are adjusted annually in June. The application deadline is January 7, 1994. Inquiries should be sent to Barbara McDonald, Advanced Study Program, NCAR, P.O. Box 3000, Boulder, Colorado 80307-3000.

**National Research Council.** *Resident, Cooperative, and Postdoctoral Research Associateship Programs.* 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. Initiated in 1954, the Associateship Programs have contributed to the career development of over 7000 scientists ranging from recent Ph.D. recipients to distinguished senior scientists. About



350 new full-time Associateships will be awarded on a competitive basis in 1994 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. nationals, 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 a shorter period. Annual stipends for recent Ph.D.'s for the 1992 program year ranged from \$27,500 to \$44,000 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 to the National Research Council must be postmarked no later than January 15, April 15, and August 15 for reviews in February, June, and October, respectively. 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 (GR430/D2), 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 write to: CAA Coordinator, National Science Foundation, Room 516, Washington, DC 20550; 202-357-7456.

**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, N.W., Washington, DC 20550.

**National Science Foundation.** *Mathematical Sciences Postdoctoral Research Fellowships.* (With Research Instructorship Option). The format of the 1994 Fellowship program has not been significantly changed from that of 1993. The stipend portion of the awards will consist of support for two nine-month academic years and six summer months, for a total of 24 months of support. The awardee will have two options for the academic years' stipend: as full-time support for any eighteen academic-year months in a three-year period, in intervals not shorter than three consecutive months (the Research Fellowship Option), or as 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). The stipend will be paid at the rate of \$2,750 per full-time month or \$1,375 per half-time month, for a total of \$66,000 for the eighteen academic months and six summer months. Deadline for applications is October 15, 1993; awards will be announced on or about February 15, 1994. For further details write to the Office of Special Projects, Room 339, Division of Mathematical Sciences, National Science Foundation, 1800 G Street, NW, Washington, DC 20550 or call 202-357-3453.

**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) 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) 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 1995. 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. 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, nationals, 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 write to: RPG Coordinator, Room 516, National Science Foundation, Washington, DC 20550; 202-357-9549.

**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 be considered, as will

proposals for periods of up to 36 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 202-357-7456 or write to obtain a Visiting Professorship Program announcement to: Program Director, Visiting Professorships for Women, Graduate Education and Research Development, National Science Foundation, Washington, DC 20550.

**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 1994. 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, 1994. For application information, contact Morris K. Udall Congressional Fellowship, Personnel Office, Office of Technology Assessment, 600 Pennsylvania Ave., S.E., 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 1994-1995 Fellowships may be obtained from The President's Commission on White House Fellowships, 712 Jackson Place, N.W., Washington, DC 20503. Telephone 202-395-4522. The application deadline is December 15, 1993.

**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 1994-1996, and are nonrenewable. The normal teaching load is two courses per semester; there will be a one course reduction during the spring semester of 1995. Advanced courses are encouraged; the Department presently has 180 graduate students. Candidates are expected to have a Ph.D. degree in mathematics prior to September 1994. 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, Indiana 47907-1395. The deadline for applications is January 10, 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, 1993 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, Texas 77251.

- **Rutgers, The State University of New Jersey.** Department of Mathematics, New Brunswick, NJ, anticipates the following open positions beginning September 1993. *Hill Assistant*

*Professorships.* These are three-year non-renewable 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 approx. 6 hours per semester but one course teaching reduction provided in two of the three years, resources permitting. Send resume and at least three letters of recommendation to Search Committee, Department of Mathematics, Rutgers University, New Brunswick, NJ 08903 as soon as possible. Indicate position desired and give # of your area of specialty according to AMS Mathematics Subject Classification. 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 in 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, New York 10111.

**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 Education Programs, 9700 South Cass Avenue, Argonne, Illinois 60439; Brookhaven National Laboratory, Upton, New York 11973; Northwest College and University Association for Science (NORCUS), 390 Hanford St., Richland, Washington 99352-1620; Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, Tennessee 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, Maryland

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, 1993. 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 one appointment for the year 1994–1995, subject to administrative approval. This award will be made to a mathematician with a recent Ph.D. who shows strong promise in research. The appointment 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](mailto:search@math.ucla.edu) or in writing to Thomas M. Liggett, Chair, Department of Mathematics, University of California, 405 Hilgard Avenue, Los Angeles, California 90024-1555, Attn: Staff Search. Preference will be given to applications completed by January 1, 1994. 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 1991) in mathematics or expect to receive one prior to July 1994. 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 vitae 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, California 92093-0112. Please indicate primary research area (field and #) using the AMS Mathematical Review Classification List. All applications received by January 4, 1994 will receive thorough consideration. All supporting material must be received no later than January 11, 1994. 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 of at least \$39,500. 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, 1994. Further information and application forms may be obtained from the Appointments Secretary, Department of Mathematics, University of Chicago, 5734 S. University Avenue, Chicago, Illinois 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 1994–1995 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 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 3. Applications should be made to D.J. Lewis, Chairman, Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48109-1003. Affirmative Action Employer.

**University of Minnesota-Minneapolis.** *Dunham Jackson Instructorship.* This is a three-year appointment from fall 1994 to spring 1997 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 Jan. 1, 1993, and no later than Sept. 15, 1994. Summer school teaching may be available during summer of 1995 and 1996 to supplement regular stipend. Salary competitive. Consideration of applications will begin 12-1-93. 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, 1994. Applicants should have received a Ph.D. in mathematics before start of the appointment, but no earlier than 1992, and are expected to show promise of significant accomplishment. The position carries a reduced academic year teaching load. Salary will be at least \$35,000 and there is an additional discretionary research fund of \$1,500. A letter of application, vitae and publications, and three letters of recommendation should be received by December 15, 1993. Write to: Personnel Committee, Department of Mathematics, University of Pennsylvania, Philadelphia, Pennsylvania 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 fel-

lowships 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 vita; 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, 1994. 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, 1994. 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 1993 or 1994. There are no restrictions on applicants' fields of interest. To apply, send a vita and have three letters of recommendation submitted by January 1, 1994, to R H Bing Faculty Fellowships, Department of Mathematics, The University of Texas, Austin, Texas 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 1993 or 1994 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be \$34,000; 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 \$38,000. 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, Utah 84112. Offers are expected to be made beginning January 1, 1994, 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 1993–1994 salary is \$38,500. 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 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, Connecticut 06520. Deadline for applications and supporting materials is January 1, 1994.

### 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, New York 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, New York 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, Centro de Investigación del IPN, Apartado Postal 14-740, 07000, México, D.F., México, Phone (011-525) 754-4466, Telex 017-72826 PPTME, Fax (011-525) 752-64-12; Bitnet MATEMAT@CINVESTAMX.

**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, New York 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 to the Hebrew University may apply not later than 3 years after completion of their doctoral dissertation. Deadline for completed applications is December 1, 1993. 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, 1993. 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, New York 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, Africa, Canada, Russia, and Ukraine. (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.

**Alexander von Humboldt Foundation. *Research Fellowships.*** Up to 600 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 6-24 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 3,000 to DM 3,800 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 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, Jean-Paul-Str. 12, D-5300 Bonn 2, Federal Republic of Germany.

**Indo-American Fellowship Program.** Approximately eighteen grants to be awarded to U.S. citizens for advanced research in India, for six- to ten-month periods during the academic year. In addition to a basic grant there are travel, dependent and research allowances. Also up to nine shorter grants (two- to three-months) for research and/or professional activity. Applications are encouraged from non-Indian specialists and for projects which include collaboration with Indian colleagues. Deadline for applications June 15 each year. For details write the Council for International Exchange of Scholars, Attention: Indo-American Fellowships Program, 3007 Tilden St., NW, Suite 5M, Washington, DC 20008-3009.

**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 Union, 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 1994, 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, including short information about their curriculum and their proposed research program, as well as the name(s) of the Italian mathematician(s) they would like to work with. 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 participant. Apply by January 15 for the following academic year. Write to Kosciuszko Foundation, Domestic Grants Office, 15 East 65th Street, New York, New York 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 18; to commence the following September; Age Limit: 25 years. Apply through British Consulates-General in the following regions (1) Northeast: Federal Reserve Plaza, 25th Floor, 600 Atlantic Avenue, Boston, Massachusetts 02210; (2) Mideast: British Embassy

Cultural Dept., 3100 Massachusetts Avenue, NW, Washington, DC 20008; (3) South: Marquis One Tower, Suite 2700, 245 Peachtree Center Avenue, Atlanta, Georgia 30303; (4) Midwest: 33 North Dearborn Street, Chicago, Illinois 60602; (5) Pacific: 1 Sansome Street, San Francisco, California 94104.

**National Academy of Sciences (NAS).** *Individual Exchange and Project Development Visits.* The NAS invites applications from American scientists who wish to make visits 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 1995. The program of two-week project development visits will support two cycles of visits: January through June 1995 and July through December 1995. 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 six months prior to the requested beginning date of their visit in physics; chemistry; mathematics and computer sciences; earth, atmospheric, and oceanographic sciences; agricultural, forestry, fishery, and plant sciences; biological sciences; environmental sciences; engineering; archaeology and anthropology; geography; psychology; science and technology policy; or the history and philosophy of science. 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 25, 1994. Applications for long-term individual exchanges (1-6 months) to travel or host in 1995 must be postmarked by June 25, 1994. Applications for the second round must be postmarked by December 10, 1994. 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 Canada; Canadian Space Agency; Communications Canada; National Defence; Energy, Mines and Resources Canada; Environment Canada; Fisheries and Oceans; Forestry Canada; Health and Welfare 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, 1992, 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, 200 Kent 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, 1993. Applications will be available in late August 1993. For information and application material, write to NATO Program, Division of Graduate Education and Research Development, National Science Foundation, Washington, DC 20550.

**Research Fellowships in India.** The Council for International Exchange of Scholars has announced the availability of eight long-term (6-10 months) and nine short-term (2-3 months) awards for research in India during 1994-1995. These grants are available in all academic disciplines except clinical medicine. The purpose of the program is to open

new channels of communication between academic and professional groups in the U.S. and India and to encourage a wider range of research activity between the two countries than currently exists. Scholars and professionals with limited or no prior experience in India are especially encouraged to apply. Applicants must be U.S. citizens at the postdoctoral or equivalent level. The terms of the fellowships include \$1700 per month, of which \$800 per month is payable in dollars and the balance in rupees, and an allowance for books, study and travel in India, and international travel for the grantee. Long term grantees receive additional allowances, including funds for dependents. The program is sponsored by the Indo-U.S. Subcommission on Education and Culture and is funded by the United States Information Agency, the National Science Foundation, the Smithsonian Institution, and the Government of India. The application deadline is August 1, 1993. Application forms and further information are available from: Council for International Exchange of Scholars, Attn: Indo-American Fellowship Program, 3007 Tilden St., NW, Suite 5M, Washington, DC 20008-3009; 202-686-4017.

**The Research Council of Norway.** *Postdoctoral Fellowships.* Fields: engineering and applied sciences. Studies can be carried out at the Universities of Oslo, Bergen, Trondheim or Tromsø, and at institutes for applied research in the same areas. English may be used at all institutes. Deadline is September 1 and March 1. Write to Department for Scientific and Industrial Research (NTNF), P.O. Box 70, Tåsen, 0801 Oslo 8, Norway; (+47) 22 23 76 85; Telefax: (+47) 22 18 11 39.

**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, 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, New York 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, Hafnarstraeti 7, Box 57, 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, New York 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 post-graduate 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 \$14,850 each. The deadline is December 1. For more information, contact: AAUW Educational Foundation, International Fellowships, 1111 16th St., NW, Washington, DC 20036; 202-728-7603.

**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, New York 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 2000 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. 1993/1994. Annual. \$42.95 (plus \$4.00 postage and handling). IIE Books, Institute of International Education, 809 United Nations Plaza, New York, New York 10017.

**American Association of University Women Educational Foundation.** American Fellowships, Selected Profession Fellowships, and Career Development Grants. Programs Office, 1111 16th St., NW, Washington, DC 20036, or call 202-728-7603.

- **Annual Register of Grant Support, 1993.** 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. \$165.00 plus \$6.75 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 per 100 plus \$4.00 shipping and handling. IIE Books, Institute of International Education, 809 United Nations Plaza, New York, New York 10017.

**Chronicle Career Index, 1993-1994.** Annotated bibliographic listing of over 500 sources of publications and audiovisual materials. Order #502CI, ISBN 1-55631-210-5, \$14.25 plus \$1.43 shipping and handling. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, New York 13118-1190; 1-800-622-7284; fax: 315-497-3359.

**Chronicle Financial Aid Guide, 1993/1994.** Order #502A. ISBN 1-55631-209-1. \$19.97 plus \$2.00 postage and handling. Revised annually. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, New York 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, 1993-1994.** Lists 2,130 colleges and 750 majors. Data covered include degrees, accreditation, enrollment, admissions, costs, and aid. Order #502CM4, ISBN 1-55631-207-5, \$19.99 plus \$2.00 shipping and handling. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, New York 13118-1190; 1-800-622-7284; fax: 315-497-3359.

**Chronicle Two-year College Databook, 1993-1994.** Provides information on 2,370 colleges, over 700 occupational-career programs, nondegree and degree programs, accreditation, enrollment, admissions, costs, and financial aid. Order #502CM2, ISBN 1-55631-208-3, \$19.96 plus \$2.00 shipping and handling. Chronicle Guidance Publications, Inc., 66 Aurora Street, P.O. Box 1190, Moravia, New York 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, New Jersey 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, Maryland 20896. \$30.

**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, New York 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). 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 M-500, Washington, DC 20008-3009; 202-686-4000.

**Fulbright and Other Grants for Graduate Study Abroad.** List of grants for graduate study and research abroad, administered by the I.I.E. for U.S. citizens. Request copy of brochure from U.S. Student Programs, Institute of International Education, 809 United Nations Plaza, New York, New York 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. IIE Books, Institute of International Education, 809 United Nations Plaza, New York, New York 10017.

**Graduate School and You: A Guide for Prospective Graduate Students.** Council of Graduate Schools, 2nd Edition, 1991. 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.** 1993-1995. Lisa Williams, (ed.), St. Martin's Press, 175 Fifth Avenue, New York, New York 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 \$89.95. Biennial.

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**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 Union, and Mongolia; grants to promote new exchanges; collaborative projects in the social sciences and humanities; developmental fellowships; 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: Mathematical Sciences Division, Office of Naval Research, Arlington, Virginia 22217-5660. Information on ONR Fellowships is available from the Special Programs Office at the same address.

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**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@prehall.com; ISBN 0-13-045345-5 (paper), 325 pp., \$19.95; ISBN 0-13-045337-4 (cloth), 325 pp., \$29.95.

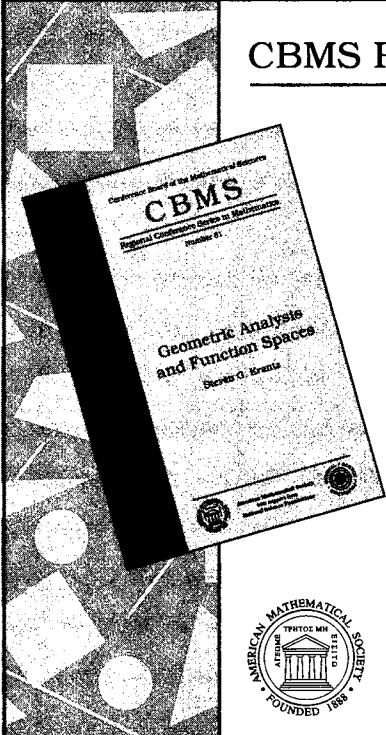
**U.K. Central Bureau Publications.** The Central Bureau is the agency funded by the education ministries of the

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 1,500 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. 1993/1994. Annual. \$36.95 (plus \$4.00 postage and handling). IIE Books, Institute of International Education, 809 United Nations Plaza, New York, New York 10017.

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## POSITIONS AVAILABLE

### CALIFORNIA

#### POMONA COLLEGE Claremont, California

Pomona College seeks applicants for a tenure track position at the assistant professor level. Candidates from all fields of mathematics will be considered. The strongest candidates will have postdoctoral experience and be excited about teaching our culturally and intellectually diverse student body, of which about a third of the mathematics majors are women. They should also be committed to continuing a strong research program.

Send application materials to:  
The Search Committee  
Department of Mathematics  
Pomona College  
Claremont, CA 91711-6348

Include a curriculum vitae and 3 letters of recommendation (which include evaluations of teaching), graduate school transcripts, and a description, written for the nonspecialist, of research accomplishments and plans. Applications will be reviewed starting January 7, 1994. Let us know if you will be at the January AMS meeting. We especially encourage applicants from traditionally underrepresented groups. Pomona College is an AA/EO employer.

### UNIVERSITY OF CALIFORNIA AT BERKELEY

#### Department of Mathematics Temporary Professional Research Position

Applications are invited for a one year non-tenure track position as Assistant Research Mathematician to assist in a research project on dynamical neural networks. Position begins November 30, and is renewable up to two additional years depending on funding. The project involves a collaboration of mathematics, biology, and engineering professors on the development and application of biological models to engineering problems. Applicants will be evaluated on the suitability of educational background and research experience to the project requirements.

A minimum of three to four years postdoctoral research experience in the field of dynamical neural networks involving both theoretical mathematical work and numerical investigation is required. Experience with oscillating and chaotic networks, and with their application to pattern recognition and grammatical inference problems is desirable. At least two years experience is needed in computer graphics and C language programming. Educational background and modeling experience in vertebrate neurobiology, preferably cortical networks, is desired. Strong publication record in neural network research is emphasized.

Applicants should send a resume, list of publications, relevant reprints or preprints, and three letters of recommendation to Research Position, The Center for Pure and Applied Mathematics, Department of Mathematics, University of California, Berkeley, CA 94720. Deadline for the receipt of applications is November 1, 1993. Applications received after that date will not be

considered. The University of California is an Equal Opportunity, Affirmative Action Employer.

### UNIVERSITY OF CALIFORNIA, IRVINE Department of Mathematics Irvine, CA 92717-3875

Applications are invited for 2 regular faculty positions at the Assistant Professor level or above. Priorities will be placed on the following 2 broadly interpreted areas:

1) Geometry—including arithmetic geometry, algebraic geometry, topology, and geometric analysis.

2) Nonlinear Analysis—including mathematical physics and applied mathematics.

Very strong promise in research and teaching is required for the Assistant Professor level. Candidates for the Associate Professor level or above are expected to have an established research and teaching record commensurate to the rank. Applicants should send a resume, reprints, prints, dissertation abstract (in the case of Assistant Professor candidates), and names and addresses of three people to contact for letters of recommendation to: Recruitment Committee, at the above address. The deadline for application is October 31, 1993, 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 Department of Mathematics

#### TEMPORARY POSITIONS:

Subject to availability of resources and administrative approval:

(1) One E.R. Hedrick Assistant Professorship. 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, 1994.

(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, 1994.

(3) One Adjunct Assistant Professorship or Lectureship in the Program in Computing (PIC). (a) Applicants in the first category must show very strong promise in teaching and research, preferably in an area related to computing. Teaching load: four quarter programming courses and an advanced quarter course of the candidate's choice per year. One year appointment, probably renewable once. Salary range \$39,600-\$47,000. (b) Applicants for the Lectureship must show very strong promise in the teaching of programming. M.S. in Computer Science or equivalent degree 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 based on experience and begins at \$34,248.

Preference will be given to applications completed by February 1, 1994.

(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 Thomas M. Liggett, Chair, Department of Mathematics, University of California, Los Angeles, CA 90024-1555. Attn: Staff Search. UCLA is an equal opportunity/affirmative action employer.

## COLORADO

### UNITED STATES AIR FORCE ACADEMY Faculty Position in Mathematical Sciences

The Department of Mathematical Sciences anticipates the establishment of a new teaching position at the rank of assistant professor beginning July 1, 1994. The initial appointment will be for three years. Reappointment will be based on qualifications, performance, and vacancies. The Air Force Academy is an undergraduate institution which awards the Bachelor of Science degree as part of its mission to develop and inspire air and space leaders. The successful candidate will have a strong commitment to undergraduate teaching and an interest in the use of computers to enhance mathematics education. Preference will be given to those who have demonstrated potential for excellence and innovation in teaching mathematics to students pursuing nontechnical as well as technical majors. Some consideration will be given to research projects that can involve undergraduates. A Ph.D. (preferably recent) in Mathematics or Applied Mathematics is required. Applicants must be U.S. citizens. Salary and academic rank will be commensurate with qualifications. Send a letter of application; curriculum vitae; transcripts; and the names, addresses, and phone numbers of three references to: USAFA/DPCS (Attn: Mrs. den Herder, #94-01MS), 8034 Edgerton Drive, Suite 240, U.S. Air Force Academy, CO 80840. Deadline for application is December 15, 1993. The Federal Government is an equal opportunity employer.

## FLORIDA

### JACKSONVILLE UNIVERSITY

Jacksonville University is soliciting applications for one and possibly a second tenure-track Assistant Professor position in mathematics. All fields of specialty are welcome, but preference for the first position will be given to a Ph.D. in statistics. Applicants with experi-

ence or interest in computer-assisted instruction are particularly desired. Responsibilities include teaching 12 hours per semester, continued scholarly activity (broadly defined), and department/university service. Applications will be accepted until December 15, 1993. Send vita, cover letter addressing qualifications, and three letters of reference to Dr. Charles Lindsey, Chair, Department of Mathematics, Jacksonville University, 2800 University Blvd. N., Jacksonville, FL 32211. Jacksonville University is an AAEO employer.

## UNIVERSITY OF FLORIDA

Applications are invited for at least two tenure track positions in Mathematics in the following areas:

- (1) applied mathematics with emphasis in numerical analysis, partial differential equations and optimization;
- (2) harmonic analysis;
- (3) algebraic number theory and algebraic geometry.

Truly outstanding candidates in other fields may be considered, but the Department will give preference to candidates in these fields. Appointments commence in August 1994. Junior applicants must show strong research promise, and senior applicants should have demonstrated leadership in research. Applicants will be expected also 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 32611-2082

Applicants should supply evidence of commitment to teaching and arrange for at least three letters of recommendation to be forwarded to the address above.

UF is an Affirmative Action Employer, and the Department especially welcomes applications from women and minority candidates. Full consideration will be given to candidates whose materials arrive by December 15, 1993.

## GEORGIA

### UNIVERSITY OF GEORGIA Department of Mathematics Athens, GA 30602

Applications are invited for one or more tenure track positions at the assistant professor level for the 1994-95 academic year. For one position the department is particularly interested in candidates in the area of applied probability. The principal qualification is excellence in teaching and research. Women and minorities are encouraged to apply. Salary will be commensurate with the applicant's abilities and experience.

To apply please send curriculum vitae and four letters of recommendation to John G. Hollingsworth, Head, at the address above. Applications received by Dec. 15, 1993, are

assured of consideration. UGA is an Equal Opportunity/Affirmative Action Employer.

## VALDOSTA STATE UNIVERSITY

**Mathematics:** The Department of Mathematics and Computer Science of Valdosta State University invites applications for two tenure-track positions at the Assistant or Associate Professor level beginning September 1, 1994. The Ph.D. is preferred; ABD with Master's degree in mathematics or statistics required. The positions are limited to applicants in the areas of statistics, operations research, stochastic processes, and optimization. Applicants should have a commitment to excellence in teaching and continued scholarly activity.

Application deadline is December 15, 1993. A letter of application, a vitae, and three letters of reference should be sent to John W. Schleusner, Head, Department of Mathematics and Computer Science, Valdosta State University, Valdosta, Georgia 31698. VSU is an AA/EOE.

## ILLINOIS

### UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN Department of Mathematics

Applications are invited for one or more junior assistant professor (tenure-track) faculty positions to commence August 1994. We are particularly interested in hiring in the area of applied mathematics, but outstanding candidates in all fields of mathematics are encouraged to apply and will be seriously considered. Salary and teaching load are competitive. Candidates must have received the Ph.D. on or after January 1, 1990, and must have completed the Ph.D. by the time the appointment begins. Candidates should send a letter of application, curriculum vitae and publication list, and arrange to have three letters of reference sent directly to the address below. Area of research should be identified using the 2-digit *Mathematical Reviews* subject classification scheme.

Gerald J. Janusz, Chair  
Department of Mathematics  
University of Illinois at  
Urbana-Champaign  
1409 W. Green St.  
Urbana, Illinois 61801  
tel: 217-333-3352  
e-mail: search@math.uiuc.edu

In order to ensure full consideration, all application materials including letters of reference should be received by December 10, 1993. Interviews may be conducted prior to December 10, but all completed applications received by that date will receive full consideration. Candidates are expected to present evidence of excellence, or potential for excellence, in research and teaching. Applications from women and minority candidates are especially encouraged. The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

## INDIANA

### INDIANA UNIVERSITY-PURDUE UNIVERSITY AT INDIANAPOLIS (IUPUI) Department of Mathematical Sciences

The Department of Mathematical Sciences at IUPUI is seeking applicants for two or more tenure-track positions to begin in August 1994. Rank is open depending on qualifications. Applicants must have an earned doctorate by the starting date. A strong research record or excellent research potential as well as a commitment to quality graduate and undergraduate teaching are required. Some preference may be given to applicants in scientific computing and applied statistics. However, strong applicants from all areas of mathematical sciences are encouraged to apply.

IUPUI is a comprehensive urban university with over 28,000 students. The department offers programs of study leading to Purdue University B.S., M.S., and Ph.D. degrees. The university offers competitive salaries and provides excellent fringe benefits. Send resume and three letters of recommendation to Prof. C. D. Aliprantis, Acting Chair, Department of Mathematical Sciences, IUPUI, 402 N. Blackford Street, Indianapolis, Indiana 46202-3216. Closing date: January 15, 1994. Late applications will be considered until positions are filled.

IUPUI is an Affirmative Action/Equal Opportunity Employer. Women and minority candidates are encouraged to apply.

## MARYLAND

### THE JOHNS HOPKINS UNIVERSITY Department of Mathematical Sciences

Applications are invited for an anticipated faculty position in Statistics.

Substantial capabilities in statistical theory, applications and methodology are required. A broad mathematical and statistical background with an applied statistics specialization is desired. Selection will reflect demonstration and promise of excellence in research, teaching, and innovative applications. A Ph.D. degree is required. Applicants at all levels will be considered.

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, 220 Maryland Hall, The Johns Hopkins University, Baltimore, Maryland 21218-2689

## MASSACHUSETTS

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If you feel you are interested in a challenging opportunity in an intellectually stimulating environment, please send or fax your resume to:

Elizabeth Mye  
Human Resources  
Thinking Machines Corporation  
245 First Street  
Cambridge, MA 02142  
Fax: 617-234-4421

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### WILLIAMS COLLEGE Department of Mathematics Williamstown, Massachusetts 01267

Anticipated tenure-eligible position in statistics, beginning Fall 1994, probably at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and statistics, including scholarship and consulting, and doctorate required.

Please have a vita and three letters of recommendation on teaching and statistics sent to Statistics 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 1994-95 year, 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 a vita and two 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.

## NEW JERSEY

### DIRECTOR OF DIMACS

DIMACS, the National Science Foundation Center in Discrete Mathematics and Theoretical Computer Science (and supported in part by the NJ Commission on Science and Technology), a consortium of Rutgers and Princeton Universities, AT&T Bell Laboratories and Bellcore, is seeking a new Director to begin on or after June 1, 1994. The Director will hold a professorial faculty appointment at Rutgers University in an appropriate mathematical science department and is expected to participate in the undergraduate and graduate programs of the department. Moreover, the Director should have a distinguished research record and should be a leader in some area of discrete mathematics and/or theoretical computer science.

The Director has four major responsibilities: (1) Coordinating the Center's scientific activities, including those of its visitors, postdocs, and over 100 scientists who are permanent members of DIMACS; (2) Providing administrative support and oversight to DIMACS' extensive precollege and undergraduate educational programs; (3) Assuming administrative and budgetary responsibility, including liaison with NSF; and (4) Raising funds for the Center's programs.

Applications are due November 1, 1993, but will be accepted until the position is filled. Send nominations and applications to the following address:

Chair, DIMACS Search Committee  
DIMACS Center  
Rutgers University  
P.O. Box 1179  
Piscataway, NJ 08855-1179  
e-mail:

<search@dimacs.rutgers.edu>  
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## NEW YORK

### CITY COLLEGE OF CUNY Asst. or Assoc. Professor Dept. of Mathematics

The Dept. of Mathematics of the City College of CUNY anticipates making one or more tenure track appointments beginning Fall 1994 at the Asst. or Associate Professor level. Significant achievements or outstanding potential in research and evidence of excellence in teaching are required. Strong preference will be given to candidates with at least one year of postdoctoral experience.

Applications are especially invited in active areas of departmental research. These include algebra, computational group theory, differential geometry, dynamical systems, probability, statistics, and topology. Successful candidates will be encouraged to interact with the mathematics doctoral program located at the CUNY graduate center and with campus-based doctoral

## Classified Advertisements

programs in the sciences, engineering, and computer science. Exceptional candidates in other areas will also be considered. Women and minority candidates are particularly encouraged to apply.

The salary range is \$29,931–63,202 as of 2/1/94. The closing date for applications is February 1, 1994, but applications will be considered until the position is filled. Applicants should send a resume, including a brief description of current research interests, and have three letters of reference sent to Professor Jack Barshay, Chairman, Dept. of Mathematics, City College of CUNY, Convent Ave. at 138th Street, New York, NY 10031. An AA/EO Employer M/F.

### MATHEMATICAL SCIENCES INSTITUTE

The Mathematical Sciences Institute of Cornell University and the State University of New York at Stony Brook has positions available for scientific visitors for the year beginning August 1994. For these positions, MSI prefers visitors not more than five years beyond the doctoral degree. Appointments are for the academic year with possible extension to a second year. Salary is \$35,000, plus benefits. Send application, to include a letter of research interests; curriculum vitae with list of publications; and three letters of support, one from the thesis advisor, to the attention of the coordinator listed below. Reprints of publications are appreciated. Qualified women and minority applicants are encouraged to apply. Applications are due January 3, 1994.

Appointments may be available in Nonlinear Analysis (attn. J. Glimm), Hybrid Systems (attn. A. Nerode), Symbolic Computation/Computer Algebra/Computational Complexity (attn. M. Sweedler), and Stochastic Analysis (attn. R. Durrett).

Send to:

Mathematical Sciences Institute  
Suite 321, 409 College Avenue  
Ithaca, New York 14850-4697

For information, contact MSI: 607-255-8005, fax: 607-255-9003, or e-mail: deede@msiadmin.cit.cornell.edu. Appointments are contingent upon continued funding of the above research areas. MSI is partially funded by the U.S. Army Research Office. Cornell University is an Equal Opportunity/Affirmative Action Employer.

### NORTH CAROLINA

#### DUKE UNIVERSITY Department of Mathematics

Applications and nominations are invited for one tenure/tenure-track position in applied mathematics or nonlinear dynamics. Rank and salary are open; the position is to start September 1, 1994. Applicants should send a curriculum vitae, a research plan, and a completed information form (available from the department at [apply@math.duke.edu](mailto:apply@math.duke.edu); and they should arrange for three letters of recommendation to be sent. A teaching recommendation is also strongly suggested. Complete applications received by January 1, 1994, will be guar-

anteed full consideration. Address correspondence to: Faculty Search Committee, Department of Mathematics, Duke University, Box 90321, Durham, NC 27708-0321. Duke University is an affirmative action/equal opportunity employer.

### OHIO

#### THE OHIO STATE UNIVERSITY Department of Mathematics

The Department of Mathematics of The Ohio State University hopes to have available several junior positions, both temporary and tenure track, effective Autumn Quarter 1994. Candidates in all areas of applied and pure mathematics are invited to apply. Significant mathematical research accomplishments or exceptional promise, and evidence of good teaching ability, will be expected of successful applicants.

Please send credentials and have at least three letters of recommendation sent to Professor Dijen Ray-Chaudhuri, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, Ohio 43210. Review of résumés will begin immediately.

The Ohio State University is an Equal Opportunity/Affirmative Action employer. Qualified women and minority candidates are encouraged to apply.

### PENNSYLVANIA

#### CARNEGIE MELLON UNIVERSITY Zeev Nehari Assistant Professorship in Mathematics

The Zeev Nehari Assistant Professorships have been instituted in the Department of Mathematics of Carnegie Mellon University to honor the memory of Professor Zeev Nehari, a member of the Department from 1954 to his death in 1978. The position available is for an initial period of one or two academic years, beginning in September 1993, and extendable for one additional year when mutually agreeable. It carries a reduced academic year teaching load of six hours per week during one semester and three hours per week during the other. Applicants are expected to show exceptional research promise, as well as clear evidence of achievement and should have research interests which intersect those of 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 the committee. All communications should be addressed to:

Appointments Committee  
Department of Mathematics  
Carnegie Mellon University  
Pittsburgh, PA 15213

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#### CARNEGIE MELLON UNIVERSITY Center for Nonlinear Analysis Department of Mathematics

The Center for Nonlinear Analysis expects to make four to five Postdoctoral appointments for 1994-95 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 21, 1994; late applications may be considered on a space-available basis. All communications should be addressed to:

Postdoctoral Appointments Committee  
Department of Mathematics  
Carnegie Mellon University  
Pittsburgh, PA 15213

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### TEXAS

#### SOUTHERN METHODIST UNIVERSITY

The Department of Mathematics at Southern Methodist University invites applications for two tenure-track assistant professorships, with employment beginning in the Fall semester of 1994. Suitable candidates may be considered for a more senior position. All applicants must have an excellent research record in physical applied mathematics, numerical analysis or scientific computation, and a strong commitment to undergraduate and graduate teaching. The standard teaching load is two courses (six hours) per semester. Applicants who wish to be considered for a senior position must be able to supervise doctoral dissertations and a strong grant record is desirable.

The Department of Mathematics has an active doctoral program in physical applied mathematics, numerical analysis and scientific computation; research interests include asymptotic and perturbation methods, bifurcation theory, dynamical systems, fluid mechanics, mathematical biology, mathematical software, nonlinear waves, and the numerical analysis of differential equations. Fourteen of the seventeen faculty are applied or numerical mathematicians. Senior faculty include W. E. Ferguson (numerical partial differential equations), I. Gladwell (mathematical software), R. Haberman (perturbation theory), M. Melander (computational fluid dynamics), G. W. Reddien (numerical bifurcation theory), D. A. Reinelt (fluid dynamics), and L. F. Shampin (numerical ordinary differential equations). The Department of Mathematics has access to distributed workstations, good Internet connections, and a 20 processor Sequent Symmetry.

Applications will be accepted until January 7, 1994, or until the positions are filled. Send a letter of application and a vita to: Professor I. Gladwell, Chairman, Department of Mathematics, Southern Methodist University, Dallas, Texas 75275-0156. (Tel: 214-692-2506; fax:



214-768-4138). Applicants should arrange for three letters of recommendation to be sent directly to Professor Gladwell.

SMU is an equal opportunity/affirmative action Title IX employer.

I. Gladwell's e-mail addresses: gladwell@sun.cis.smu.edu.

### TEXAS A&M UNIVERSITY Department of Mathematics

Applications are invited for tenured faculty positions beginning fall 1994. The long-range plan for the department calls for a major expansion of our programs over the next three years. During this time period we expect to make a few senior appointments each year. For such a position the applicant should have an outstanding research reputation and be able to fill a leadership role in the department. An established research program, including success in attracting external funding and supervision of graduate students, will be expected and a demonstrated ability, and interest in teaching is required.

Applicants should send a vita, and arrange to have at least four letters of recommendation sent to:

William Rundell, Department of Mathematics, Texas A&M University, College Station, Texas 77843-3368; (hiring@math.tamu.edu). The Department particularly encourages applications from women and minorities.

### TEXAS A&M UNIVERSITY Department of Mathematics

We invite applications for tenure-track Assistant Professorships beginning fall 1994. The position requires strong research potential and excellence in teaching at both the undergraduate and graduate level. Contributions beyond the doctoral dissertation will normally be expected. The salary is competitive and the successful applicant will have a start-up package that will include a reduced teaching load and discretionary funds. Preference will be given to applicants whose research area augments our existing strengths.

Application materials, which must include a vita, a statement of research plans, and at least three letters of recommendation, should be sent to:

William Rundell, Department of Mathematics, Texas A&M University, College Station, Texas 77843-3368; (hiring@math.tamu.edu). The Department particularly encourages applications from women and minorities.

### TEXAS A&M UNIVERSITY Research Instructorships in Mathematics

The Department expects to have several Research Instructorships available beginning fall 1994. These are two year positions, and are intended for those who have recently received their Ph.D. Candidates must show promise of research excellence in an area of pure or applied mathematics and preference will be given

to applicants whose research area is close to those of regular department members.

Application materials must include an application letter, a vita, a statement of research goals, and three letters of recommendation. It is essential that these documents contain evidence of abilities and experience in teaching as well as research. It would be very helpful if the application letter identified members of our faculty with similar research interests.

For full consideration, the complete dossier should be sent by January 1 to:

Hiring Committee  
Department of Mathematics  
Texas A&M University  
College Station, Texas 77843-3368  
(hiring@math.tamu.edu)

Texas A&M University is an EOE/AA employer and the Department especially encourages applications from women and minorities.

### THE UNIVERSITY OF TEXAS AT DALLAS Programs in Mathematical Sciences

Applications are invited for an anticipated tenure track or tenured full professor faculty position in Applied Mathematics beginning Spring 1994. Ph.D. in Mathematics or Applied Mathematics is required. Applicants should have outstanding research record in Applied Mathematics with particular emphasis on mathematical systems theory as related to Electrical Engineering. The successful candidate is expected to participate in the activities of the Center for Engineering Mathematics. Responsibilities include research, teaching, and supervision of Ph.D. Dissertations. Excellent computing facilities.

Applicants should send a curriculum vita and at least five letters of reference (indication of sex and ethnicity for Affirmative Action statistical purposes is requested but not required) to: Academic Search #2010, M/S Ad 23, The University of Texas at Dallas, P.O. Box 830688, Richardson, Texas 75083-0688. Applications accepted until 11/15/93, or later if position not filled. AA/EEO

### 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. Two full-time tenure track appointments on the professorial levels. The Department is primarily interested in applicants who work in the research areas represented in the Department and who received their Ph.D. degrees prior to 1993. Selection will be based on research and teaching ability.

2. Two or more nonrenewable three-year Instructorships. Persons of any age receiving Ph.D. degrees in 1993 or 1994 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be \$34,000; 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.

3. 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 \$38,000. Duties consist of teaching four courses during the three quarter academic year.

4. 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, 1994, but applications for all positions will be accepted until January 31, 1994, 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.

### VIRGINIA

#### CHRISTOPHER NEWPORT UNIVERSITY Department of Mathematics Newport News, Virginia

One Tenure track position in mathematics Education at the assistant professor level is available Fall 1994. Salary is competitive.

Christopher Newport University is Virginia's newest comprehensive, state-supported university. The University is located on an attractive campus in the heart of Tidewater, enrolls over 5,000 students, and offers bachelor's degrees in 30 fields (including mathematics, computer science, and applied physics). Its master's degrees include an MAT in the teaching of mathematics and science and an M.S. in Applied Physics.

The mathematics department currently consists of eleven full time members and has part-time instructors teaching approximately thirteen sections per semester. All faculty have computers in their offices with connections to a Sun workstation network and a DecStation network. Other computing resources include a Macintosh net and a parallel processor. All nets connect to the Internet. The department offers a BA/BS in mathematics or in mathematics with concentrations in computer science, physics, or secondary teaching.

The University is ten minutes from two national labs, the Continuous Electron Beam Accelerator Facility (CEBAF) and NASA-Langley,

and high-tech companies such as Canon-USA and Colonial Williamsburg are within 30 minutes, and the mountains are within three hours.

The department is interested in candidates having ability and potential in teaching and research, and interest in curriculum development. The usual teaching load is either three or four three-credit courses in each of the two semesters.

Research backgrounds in areas appropriate to support the master's degrees in mathematics education are preferred. Effective language communication skills are essential. A Ph.D. or Ed.D. in mathematics education earned by the beginning of the contract period is required.

Candidates must send a resume indicating teaching experience and areas of specialization, and letters of reference, preferably three, to support the applicant's professional qualifications. Applications will be accepted until January 31, 1994. Send information to Professor Martin Bartelt, Chairman, Mathematics Department, Christopher Newport University, Newport News, VA 23606.

CNU is an AA/EEO Employer. Women and minorities are strongly urged to apply.

**WASHINGTON AND LEE UNIVERSITY**  
Department of Mathematics  
Lexington, VA 24450

Tenure track Assistant Professorship available fall 1994 for recent Ph.D. (1991 or later). Commitment to both quality undergraduate teaching and ongoing scholarship essential. Preference given to candidates with firmly initiated research programs in combinatorics, geometry, or operator theory.

Washington and Lee is a Highly selective liberal arts college located in the Shenandoah Valley. The Department consists of seven Ph.D. faculty members.

Send cover letter, brief statement of teaching philosophy, and vita to "Search Committee" at the above address. Also arrange for the committee to receive three letters of recommendation addressing teaching and research. Inquiries may be made to Michael J. Evans at mjevans@wlu.edu. Evaluation of completed applications will begin December 1, 1993. W&L is an equal opportunity employer and encourages women and members of minority groups to apply.

**CANADA**

**UNIVERSITÉ DE MONTRÉAL**  
Department of Mathematics and Statistics  
Montréal, Québec  
Positions in Numerical Analysis

The Department of Mathematics and Statistics of the Université de Montréal will have a tenure track position in Numerical Analysis. **Qualifications required:** Ph.D. in mathematics, expertise in modern computational methods, and mastery of at least one field of application including fluid mechanics. **Effective date of appointment:** June 1994. **Duties** include both undergraduate

and graduate teaching (in French), supervision of graduate students (M.Sc. and Ph.D.), association with the Centre for Research on Computation and its Applications (CERCA) which aims at creating a stimulating atmosphere for interaction between scientists in universities and industry, and to provide them with the best computing resources. A total of fifteen new tenure track faculty positions have been authorized for CERCA over the next five years at the four universities. **Salary** will be according to the collective agreement. **Closing for receipt of applications** March 1, 1994.

Applications including curriculum vitae, preprints, and three letters of reference should be sent to:

Chair  
Department of Mathematics and  
Statistics  
Université de Montréal  
P.O. Box 6128, Station A  
Montréal (Qc) H3C 3J7

*In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents, men and women.*

**UNIVERSITY OF WATERLOO**  
Department of Pure Mathematics

The Department of Pure Mathematics at the University of Waterloo invites applications for a tenure-track position at the Assistant Professor level starting July 1, 1994. The Department is particularly interested in candidates whose research interests are related to Algebraic Topology, Differential Geometry, Functional Analysis, or Number Theory. In order to be considered for the position, a Ph.D. is required. An appointment will be offered only to someone with very strong research and teaching qualifications. The University of Waterloo is committed to increasing the number of its female faculty, and therefore applications from women mathematicians are particularly welcome. Duties will include research, and teaching at all levels. Salary will depend on the candidates's qualifications. The closing date for applications is January 15, 1994. An application should contain the curriculum vitae of the candidate plus three letters of reference sent directly from the referees. In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. The University of Waterloo encourages applications from qualified women and men, members of visible minorities, native peoples and persons with disabilities. The availability of this position is subject to budgetary approval. Please send applications to: Dr. J. W. Lawrence, Chair, Department of Pure Mathematics, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.

**DENMARK**

**AARHUS UNIVERSITY**  
Denmark

*Chair in Pure Mathematics.* The Institute of Mathematics at Aarhus University invites applications for a chair in Pure Mathematics. The appointment is expected to take effect from August 1, 1994, or as soon as possible thereafter. The salary is at the moment approximately dkr. 390,000.

Candidates should have a proven research record and demonstrate strong academic leadership qualities. The applicants will be assessed by a selection committee whose final report will be made available to all applicants.

Applications should contain Curriculum Vitae, a list of publications, five copies of each of your 5-10 best publications, a description of previous teaching experience, and the names of 2-3 persons from whom letters of reference may be obtained.

Please address your application to the Queen of Denmark and mail it to Journalkontoret, Aarhus Universitet, Ndr. Ringgade 1, 8000 Aarhus C, Denmark. It should be marked 211/5-4.

Deadline for applications: November 1, 1993.

For further information please contact Professor Ib Madsen, Matematisk Institut, Ny Munkegade, DK 8000 Aarhus C, Telephone: +45 08942 3451, e-mail: imadsen@mi.aau.dk.

**ENGLAND**

**LEIBNIZ POSTDOCTORAL  
FELLOWSHIPS IN MATHEMATICS**  
Second Round

**Human Capital and Mobility Programme**

Applications are invited for a number of 2 year fellowships for research in any area of mathematics, to be held at any one of the institutions in the following network: **CRM, Institut d'Estudis Catalans, Barcelona; Max-Planck-Institut für Mathematik, Bonn; Department of Pure Mathematics & Mathematical Statistics or Newton Institute, Cambridge; DMI, Ecole Normale Supérieure, Paris; Département de Mathématiques, Orsay, Paris**

**Conditions:** Applicants must be citizens of a member state of the European Community or resident in the Community, be under 33, and expect to have completed a Ph.D. or equivalent degree by 1 October 1994. Exceptionally, consideration may be given to applicants who expect to finish by 1 October 1995. Applicants should propose at least 2 institutions at which they would accept appointment, each of which must be outside their country of citizenship or residence, and other than the institution at which their doctoral studies have been carried out. In all cases successful candidates will be expected to take up their fellowships on 1 October 1994. Holders of the fellowships will be encouraged to spend 6 months at a second network institution. Information concerning salaries and the main mathematical interests of the various institutions



## Classified Advertisements

can be obtained from the coordinator (e-mail: leibniz@pmms.cam.ac.uk).

**Applications:** These must include a c.v., list of publications, concise description of research interests, and the names of 3 referees, and should reach the coordinator

Dr. C. B. Thomas  
Leibniz Fellows  
Department of Pure Mathematics &  
Mathematical Statistics  
University of Cambridge  
16 Mill Lane  
Cambridge CB2 1SB  
England  
(fax: 44-223-337920)

by **30 October 1993**. Each candidate must ensure that his/her referees sent their reports so as to reach the coordinator by the same date. A network committee will make an initial selection of the fellows on 13 November 1993.

### UNIVERSITY OF CAMBRIDGE Department of Pure Mathematics and Mathematical Statistics

**University Lecturer or Assistant Lecturer in Pure Mathematics:** Applications are invited for a University Lectureship (roughly equivalent to an Associate Professorship in North America) or a University Assistant Lectureship (roughly equivalent to a tenure track Assistant Professorship in North America) in any field of mathematics, to take up appointment from 1 October 1994. Further information, and details of application procedure, can be obtained from the Head, DPMMS, 16 Mill Lane, Cambridge CB2 1SB, England (email: vacancies@pmms.cam.ac.uk; telephone: 44-223-337996; fax 44-223-337920).

The closing date for applications 1 December 1993.

**Research Associate:** Applications are invited for a 3 year Science & Engineering Research Council postdoctoral research associateship, beginning on 1 October 1994, to work with J. H. Coates and R. L. Taylor in the general area of arithmetic geometry and automorphic forms. Further information and details of application procedure can be obtained from J. H. Coates, DPMMS, 16 Mill Lane, Cambridge CB2 1SB, England (e-mail: vacancies@pmms.cam.ac.uk; telephone: 44-223-337996; fax: 44-223-337920).

The closing date for applications is 15 December 1993.

*The University of Cambridge is an equal opportunities employer.*

### UNIVERSITY OF LEICESTER Department of Mathematics and Computer Science Chair of Mathematics

Applications are invited for a newly established Chair of Mathematics in the Department of Mathematics and Computer Science. The appointment will date from 1 January 1994 or such other date as may be agreed. The applicant should have a strong research record, preferably in pure mathematics including areas related to the current research strengths of the Department. In addition to this appointment, a new Lectureship has been established and the appointee should expect to play a major role in filling this position.

Salary will be within the Professorial Range. Informal enquiries are welcome and should be addressed to Professor W. Light, Head of Department of Mathematics and Computer Science, telephone (0533) 523884.

Further particulars may be obtained from the Staffing Office (Academic Appointments), University of Leicester, University Road, Leicester, LE1 7RH, telephone: (0533) 522422, fax: (0533) 522200. U.K. candidates should submit eleven copies of their application (overseas candidates may submit one copy).

Closing date for applications is 25 October 1993.

Towards Equal Opportunities.

## MEXICO

### CENTRO DE INVESTIGACIÓN Y DE ESTUDIOS AVANZADOS DEL IPN Solomon Lefschetz Research Instructorships 1994-1995

The CINVESTAV-IPN Mathematics Department offers the **Solomon Lefschetz Research Instructorships** to young mathematicians with doctorates who show definite promise in research. Appointments are for one year. The

salary is equivalent to that of an Assistant Professor in the Mathematics Department. An allowance for moving expenses is provided. Teaching duties generally include one course per semester. Knowledge of Spanish is desirable. Deadline for applications is February 28, 1994. To apply, send curriculum vitae with outline of proposed research plan and arrange for at least three letters of reference to be sent to:

Solomon Lefschetz Instructorship  
Mathematics Department  
CINVESTAV-IPN  
Apartado Postal 14-740  
07000 México, D. F., Mexico  
Phone: (52-5) 754-4466  
Fax: (52-5) 752-6412

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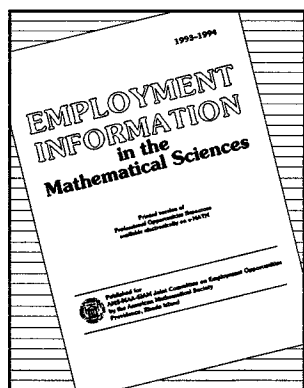
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1993 202 pp. Hardcover \$44.50 ISBN 0-8176-3721-4  
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J.-L. Brylinski, The Penn State University

This book develops a Chern-Weil theory of characteristic classes of gerbes. Gerbes (invented by Giraud) are fiber bundles whose fibers are groupoids (certain categories). Gerbes arise naturally in geometry, for instance, whenever one has a family of symplectic manifolds or a bundle of projective Hilbert spaces. A product of this theory is a geometric construction of ordinary degree 3 cohomology of manifolds, with applications to loop spaces and loop groups, group cohomology and Cheeger-Simons classes, Deligne cohomology, and the geometric quantization of the magnetic monopole.

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1993 369 pp. Hardcover \$49.50 ISBN 0-8176-3626-9  
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B. Booss-Bavnbek, Roskilde University & K.P. Wojciechowski, IUPUI

The major goal of this book is to make the theory of elliptic boundary problems accessible to mathematicians and physicists working in global analysis and operator algebras. It does not pre-suppose deep familiarity with the theory of partial differential equations. The book is about operators of Dirac type on manifolds with boundary. It focuses on elliptic differential operators of first order as, for example the Cauchy-Riemann operator, the signature operator, the Dirac operator over spin manifolds, and other generalized Dirac operators. It also deals with related, global, boundary problems like the Atiyah-Patodi-Singer condition, the Calderon projection, and other analytically or geometrically defined projections. Part One presents the analytic preliminaries and then focuses on the role of the Grassmannian of pseudo-differential projections. The second part is devoted to applications such as the index theory of generalized Atiyah-Patodi-Singer problems, cutting and pasting of the index, and the index of the General Linear Conjugation Problem.

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R.F. Brown, University of California

Here is a book for the student or professional mathematician who would like, with a minimum of background and preparation, to understand some of the beautiful results at the heart of nonlinear analysis. It is based on carefully-expounded ideas from several branches of topology, and illustrated by a wealth of figures that attest to the geometric nature of the exposition. Though the author has assumed a fairly high level of mathematical sophistication, the pace of exposition is relatively leisurely and is essentially self-contained.

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G. Lusztig, MIT

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Progress in Mathematics, Volume 110

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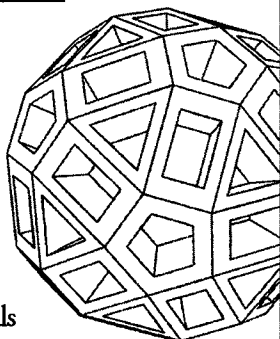
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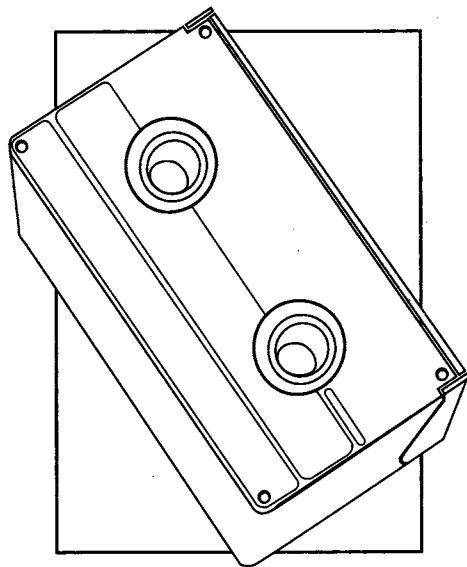
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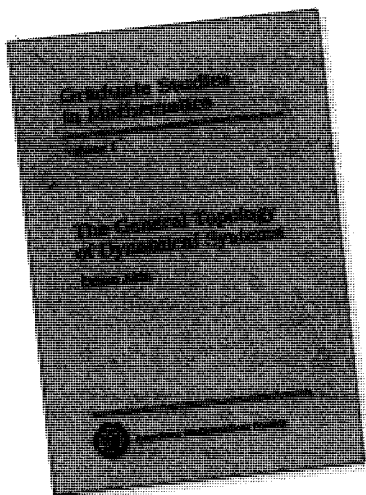
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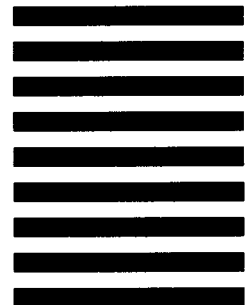
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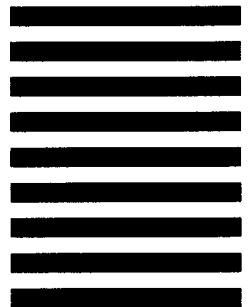
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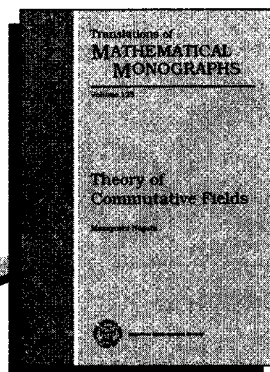
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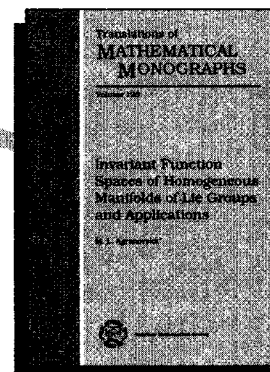
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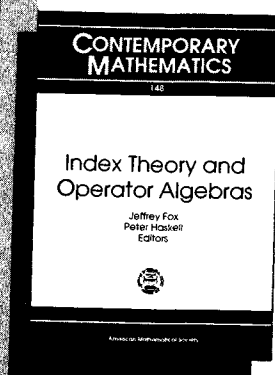
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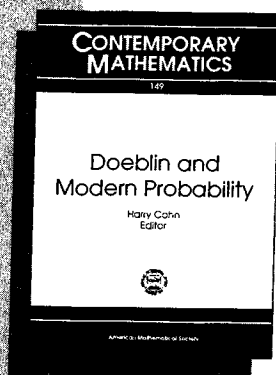


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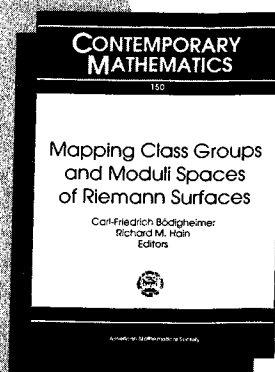


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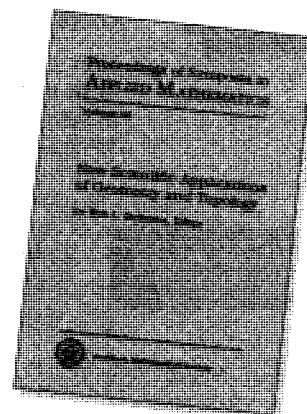
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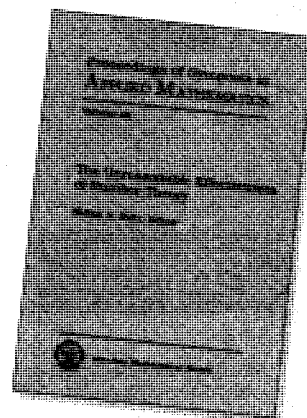


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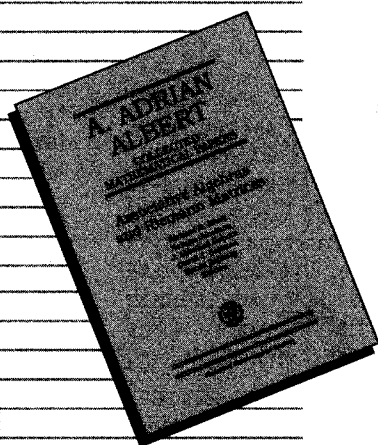
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1991 *Mathematics Subject Classification*: 11, 12, 14, 16, 17

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5. Return form with payment with your Advance Registration/Housing Form by November 12 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. \_\_\_\_\_

(A) Specialties Sought \_\_\_\_\_

Title(s) of Position(s) \_\_\_\_\_

Number of Positions \_\_\_\_\_

Starting Date \_\_\_\_\_ / \_\_\_\_\_ Term of Appointment \_\_\_\_\_  
Month Year Months Years

Renewal

☐ Possible ☐ Impossible

Tenure Track Position

☐ Yes ☐ No

Teaching Hours per Week \_\_\_\_\_

Degree Preferred \_\_\_\_\_

Degree Accepted \_\_\_\_\_

(B) Duties \_\_\_\_\_

(C) Experience Preferred \_\_\_\_\_

Significant other requirements, needs, or restrictions which will influence hiring decisions \_\_\_\_\_

Able to hire for this position :  
(check all that apply)

☐ U.S. Citizen

☐ Non-U.S. Citizen, Permanent Resident

☐ 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



# Joint Mathematics Meetings Advance Registration/Housing Form, Cincinnati, Ohio

January 12-15, 1994

Please complete this form and return it with your payment to: Mathematics Meetings Service Bureau (MMSB), P.O. Box 6887,  
Providence, Rhode Island 02940; Telephone: (401) 455-4143; Telex: 797192

**DEADLINES:** AMS Short Course, Hotel Reservations (includes Room Lottery Qualification),  
Joint Meetings (JM) & Employment Register (ER) October 29, 1993  
AMS Short Course, Hotel Reservations, JM & ER (includes Tickets, Registration  
Material Mailed In December, and Inclusion in Winter Lists) November 12, 1993  
Housing Changes/Cancellations through MMSB December 10, 1993  
AMS Short Course, Final JM & ER Registration with no Housing, Tickets,  
Inclusion in Winter Lists, or Material Mailed December 13, 1993  
50% Refund on Tickets December 30, 1993 (no refunds after this date)  
50% Refund Advance Registration/Employment Register/AMS Short Course January 9, 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.

- 1) \_\_\_\_\_ Telephone: \_\_\_\_\_  
(Please print) Surname First Middle
- 2) \_\_\_\_\_  
(Mailing address)
- \_\_\_\_\_ (Mailing address continued) \_\_\_\_\_ (e-mail address)
- 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.** ☐
- 3) Badge information: Affiliation \_\_\_\_\_  
Names for Guest Badges: \_\_\_\_\_
- 4) Students: Grad ☐ Undergrad ☐ High School ☐ 5) Emeritus member ☐ High School Teacher ☐ Librarian ☐ Unemployed ☐
- 6) Member of: AMS ☐ CMS ☐ MAA ☐ Nonmember ☐ AWM ☐ NAM ☐ MR Classification # \_\_\_\_\_
- 7) Joint Meetings fee \$ \_\_\_\_\_ 8) AMS Short Course fee \$ \_\_\_\_\_ 9) Employer fee(s) \$ \_\_\_\_\_ 10) Co-Interviewer fee(s) \$ \_\_\_\_\_
- 11) Applicant fee \$ \_\_\_\_\_ 12) Posting fee \$ \_\_\_\_\_ 13) Hotel deposit \$ \_\_\_\_\_ (necessary ONLY if paying deposit by check)
- 14) Tickets: \_\_\_\_\_ AMS 25-Year Banquet @\$25 each = \$ \_\_\_\_\_ Veg. meal ☐ \_\_\_\_\_ MER Banquet @\$36 each = \$ \_\_\_\_\_ Veg. meal ☐  
\_\_\_\_\_ NAM Banquet @\$25 each = \$ \_\_\_\_\_ Veg. meal ☐ \_\_\_\_\_ AWM Workshop Dinner @\$27.50 each = \$ \_\_\_\_\_ Veg. meal ☐  
Students, please check here if you will be attending the MathChats on Tuesday, 1/11/94. ☐
- 15) TOTAL AMOUNT ENCLOSED FOR 7 through 14 \$ \_\_\_\_\_ NOTE: May be paid by check payable to AMS (Canadian checks must be marked "U.S. Funds"), or VISA or MasterCard credit cards. ☐ original institutional purchase order attached
- Credit card type: \_\_\_\_\_ Card number: \_\_\_\_\_ Expiration date: \_\_\_\_\_  
If this is your credit card, please print your name as it appears on the credit card on the line below as well as sign your name.  
If this is not your credit card, please print card holder's name as it appears on the credit card on the line below, and have the card holder sign.

(Printed name)

(Signature)

### JOINT MATHEMATICS MEETINGS

### REGISTRATION FEES

Member of AMS, CMS, MAA	\$ 125
* Emeritus Member of AMS or MAA	35
Nonmember	194
* Students:	
High School	2
Graduate or Undergraduate	35
* High School Teachers/Librarians/Unemployed Mathematicians	35
AMS SHORT COURSE	
Member/Nonmember	70
* Student, Unemployed, or Emeritus	30
EMPLOYMENT REGISTER	
Employer (1st Interviewer)	150
Employer (2nd/3rd Interviewer)	75
Applicant	35
Posting for job descriptions for noninterviewing employers	50

\* See section on "How to Register in Advance" in the *Notices* or *Focus* for definitions of various registration categories.

For office use only:

Codes	Options	Hotel	Room type
Dates	Hotel Deposit	Total Amount Paid	
Special Remarks			

## HOUSING SECTION:

## ADVANCE REGISTRATION/HOUSING FORM, Cincinnati, Ohio

January 12-15, 1994

☐ I will not require housing.☐ I am making my own arrangements.☐ I am staying privately in the local area.☐ 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 comparative rate. Rates listed below are subject to 10% sales/occupancy tax. **GUARANTEE REQUIREMENTS:** \$50 by check **OR** a credit card guarantee with VISA, MasterCard, or American Express. Please supply this information on the reverse.

Order of choice		Distance from Conv. Ctr.	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)
	<b>Hyatt Regency Cincinnati (Headquarters)</b>	.06 miles	\$ 83	\$ 83	\$ 83	\$ 113	\$ 113	\$ 93	\$ 113	\$360+
	Regular									
	Student**		73	73	73	93	93	73	93	N/A
	<b>Westin</b>	.20 miles								
	Regular									
	Student**		82	82	82	97	97	82	97	135+
	<b>Terrace Hilton</b>	.15 miles								
	Regular		70	70	70	85	85	70	85	N/A
	Student**									
	<b>Clarion</b>	.06 miles								
	Regular		80	80	80	110	110	90	110	140
	Student**		70	70	70	90	90	70	90	N/A
	<b>Omni Netherland Plaza</b>	.15 miles								
	Regular		63	63	83	N/A	N/A	103	N/A	205+
	Student**		49	49	83	N/A	N/A	103	N/A	N/A
	<b>Holiday Inn Queensgate (downtown)***†</b>	1 mile								
	Regular		59	59	59	64	64	69	69	175+
	Student**		49	49	49	54	54	59	59	N/A
	<b>Quality Hotel Riverview†</b>	1 mile								
	Regular		55	55	55	65	65	55	65	140+
	Student**		45	45	45	55	55	45	55	N/A
	<b>Holiday Inn Riverfront***†</b>	1 mile								
	Regular		51	51	51	61	61	51	61	N/A
	Student**		41	41	41	51	51	41	51	N/A

\* Reservations for suites must be made directly with the Service Bureau. The hotel can supply general information only.

\*\* Participant must be a certified student or unemployed (as described in the "How to Register in Advance" section of *Notices or Focus*) to qualify for these rates.

\*\*\* Room types available are king sofa and double-double. Please indicate your preference below.

†The Holiday Inn Queensgate, Quality Hotel Riverview, and Holiday Inn Riverfront are not within walking distance. Complimentary shuttle service will be provided to and from these properties.

Special housing requests: \_\_\_\_\_

If you are physically challenged and have special needs, please indicate your needs above. If necessary, a staff member will call you for further information to insure that you are placed in a property that is complying with ADA rules and that your stay in Cincinnati is comfortable. Phone number where you can be reached: \_\_\_\_\_

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, departure date, and ages of children, and check here if one of the occupants is your spouse ☐

# MATHEMATICS

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