NOTICES OF THE AMERICAN MATHEMATICAL SOCIETY

International Congress of Mathematicians
Kyoto, Japan page 1209

1990 Annual AMS-MAA Survey page 1217

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Calendar of AMS Meetings and Conferences

This calendar lists all meetings which have been approved prior to the date this issue of *Notices* was sent to the press. The summer and annual meetings are joint meetings of the Mathematical Association of America and the American Mathematical Society. The meeting dates which fall rather far in the future are subject to change; this is particularly true of meetings to which no numbers have been assigned. *Programs* of the meetings will appear in the issues indicated below. *First* and *supplementary* announcements of the meetings will have appeared in earlier issues.

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. For additional information, consult the meeting announcements and the list of organizers of special sessions.

Meetings

Meeting #		Date	Place	Abstract Deadline	Program Issue
863	†	January 16–19, 1991 (97th Annual Meeting)	San Francisco, California	Expired	December
864	††	March 15–16, 1991	South Bend, Indiana	January 3	March
865	*	March 22–23,1991	Tampa, Florida	January 3	March
866	*	June 13–15, 1991	Portland, Oregon	March 26	May/June
867	*	August 8–11, 1991 (94th Summer Meeting)	Orono, Maine	May 29	July/August
868	*	October 12–13, 1991	Philadelphia, Pennsylvania	August 1	October
869	*	October 25–26, 1991	Fargo, North Dakota	August 1	October
870	*	November 9–11, 1991	Santa Barbara, California	August 1	October
871	*	January 8–11, 1992 (98th Annual Meeting)	Baltimore, Maryland	October 2	December
		March 13–14, 1992	Tuscaloosa, Alabama		
	††	March 20–21, 1992	Springfield, Missouri		
		June 29–July 1, 1992 (Joint Meeting with the London Mathematical Society)	Cambridge, England		
		January 13–16, 1993 (99th Annual Meeting)	San Antonio, Texas		
		August 15–19, 1993 (96th Summer Meeting) (Joint Meeting with the Canadian Mathematical Society)	Vancouver, British Columbia		
		January 12–15, 1994 (100th Annual Meeting)	Cincinnati, Ohio		
		January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		

* Please refer to page 1274 for listing of Special Sessions.

† Preregistration/Housing deadline is November 16

†† These dates are earlier than previously published.

Conferences

January 14–15, 1991: AMS Short Course on Probabilistic Combinatorics and Its Applications, San Francisco, California.

June 22–August 2, 1991: Joint Summer Research Conferences in the Mathematical Sciences, University of Washington, Seattle, Washington.

July 7–26, 1991: AMS Summer Research Institute on Algebraic Groups and their Generalizations, location to be announced.

Deadlines

	January Issue	February Issue	March Issue	April Issue
Classified Ads*	December 6, 1990	January 10, 1991	January 31, 1991	February 28, 1991
News Items	November 28, 1990	January 2, 1991	January 22, 1991	February 21, 1991
Meeting Announcements**	November 29, 1990	January 7, 1991	January 24, 1991	February 25, 1991

* 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.

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ARTICLES

1209 ICM-90

This article contains an overview of ICM-90 and brief discussions of the works of the Fields Medalists and the Nevanlinna Prize recipient.

1217 1990 Annual AMS-MAA Survey *First Report*

The first report on the 1990 Survey includes the 1990 survey of new doctorates, starting salaries of new doctorates, faculty salaries, and a list of names and thesis titles for members of the 1989-1990 Ph.D. class.

1251 The David II National Plan

The David II Report will have impact only if it is widely distributed and if individuals in the community are able to use the report effectively in their own institutions. To address this issue, the Board on Mathematical Sciences has developed a dissemination plan for the report, which is described in this article by Allyn Jackson.

FEATURE COLUMNS

1254 Computers and Mathematics *Jon Barwise*

This month's column contains two articles that show, in quite different ways, the profound influence that computers can have on mathematicians and mathematics. The first, by Wilfrid Kendall, has to do with computers and stochastic calculus. The second, by Keith Devlin, is a response to Barwise's editorial (October *Notices*, p. 1016) about the problems in our research universities in keeping teaching and research in balance.

1260 Inside the AMS

Taissa T. Kusma, Manager of Database Services, describes the development of MathSci over the last decade and the role of the AMS in its development, distribution and user support.

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From the Executive Director ...

ELECTRONIC INFORMATION

One of the central activities of the Society is facilitating the exchange of mathematical information. Traditionally, this has taken place through meetings and publications. Today, however, the advent of computer technology is redefining the Society's role in facilitating information exchange.

This is a challenging, exciting, and costly effort; and not everyone agrees on exactly what is challenging, what is exciting, or who ought to pay the cost. For example, it is very easy to imagine an electronic information system where all one must do to accomplish "perfect" results is A, B, and C. But typically one finds that A is very time consuming, B is prohibitively expensive, and C cannot be done.

Many in our community are not excited by electronic media. Indeed, it can be quite frustrating to grope with the intricacies of operating system commands, scanning screens of information, to have a machine make you feel stupid when you have given it a perfectly logical command (unfortunately using your own form of logic), or to stare at screen after screen of TEX coding without proper equipment or software to view the typeset result. Nonetheless, electronic information exchange is a powerful tool that can be brought to the science of mathematics. The role of the AMS is to develop ways to facilitate the community's use of this tool.

One of the most important services provided to the mathematical community by the Society is *Mathematical Reviews* (MR), with nearly 55,000 reviews annually, and *Current Mathematical Publications* (CMP), with nearly 58,000 entries annually. Together the databases for the two publications, going back to 1940 (not all of which is in electronic form), constitute the MR Database. A good portion of the MR Database is available electronically both "on-line" and on CD-ROM (Compact Disc) through MathSci (see the Inside the AMS department in this issue for a brief history of MathSci). The AMS develops and maintains electronically the *Combined Membership List* (CML), and publishes the *World Directory of Mathematicians*. The AMS now has full-time staff committed to the collection, analysis, and maintenance of several of the professional data surveys. These are the sources of the regular AMS Survey Reports in *Notices*; it is hoped that bringing this activity under the Society will lead to the development of a useful electronic database. And, of course, the Society is closely identified with the support of TEX as a coding and typesetting language for mathematics; the Society both develops and delivers software and documentation for TEX.

The Society's newest electronic information venture is known as e-MATH. This is what I call a centrally located information node—an electronic bulletin board service—on the Internet. You may have seen announcements about e-MATH in previous issues of *Notices*. Supported by the NSF and AMS, e-MATH became available this October 15. Its central features are: a name server, which allows access to the CML; electronic bulletin boards, including "moderated boards" (precursors to electronic journals in which moderators will have duties similar to those of journal editors); on-line conferencing; mathematically-oriented databases; software libraries; and document delivery. As the latest effort in the Society's commitment to the delivery of mathematical information, e-MATH is an exciting step in electronic exchange of information.

William Jaco

Letters to the Editor

Impending Shortage of Mathematicians?

There have been numerous statements in *Notices* about an impending shortage of mathematicians in this country. No doubt there are statistics to back these predictions up, but from my admittedly limited point of view, things don't look that way. Quite the contrary - of 12 people who had essentially completed their Ph.D. requirements in mathematics at Purdue in June 1989, only about half got job offers, a number of which were for somewhat exploitative one-year positions. Five of the remaining students chose to postpone getting their degrees, hoping for better luck this year; their plight was not reflected in the annual Employment Status survey. These five did get offers this year, but now there are five more in the same position.

Our experience here may be skewed by the fact that we have had only three U.S.-born Ph.D.'s in the past years (all of whom did get positions). But in my discussions with colleagues from other highly-ranked schools, the conclusion has invariably been that the job market seems tight for all but a few of the best.

What these selected observations suggest is that while there may well be too few native-born mathematicians in the pipeline, there are still considerably more qualified candidates altogether than there are openings, at least in academic "core" mathematics.

A shortage of mathematicians would indeed be a serious national matter, calling for more federal dollars. But does the emperor have clothes?

Joseph Lipman
Purdue University
(Received September 5, 1990)

EDITOR'S NOTE: Edward A. Connors, in his capacity as chair of the committee that oversees the AMS-MAA Annual Survey and as author of the recent reports in *Notices* on the survey, was contacted by the editors of *Notices* regarding the statements in the previous letter. He provided the following comments:

All the predictions of shortages I have seen have been long-term, usually focused on the turn of the century. Demographic reasons are usually supplied to support the claims of pending shortfalls in the supply of mathematicians, for example an aging mathematical sciences faculty, coupled with increases in segments of the population traditionally underrepresented in the production of doctoral scientists. For the short-term job prospects we have the increase in the number of employment seekers because of the political events in Eastern Europe and China, the downturn in the traditional college-age population, and the effects of a sluggish economy. The short-term situation might be somewhat alleviated by a vigorous campaign by department heads and chairs to increase the allocation of positions in the mathematical sciences at their own institutions, complemented by a concerted national effort to increase the number of multi-year post-doctoral appointments in mathematics. Heads and chairs should also note with considerable interest and attention the quality of advising and counseling provided for their own students who are about to enter the job market for the first time. In closing, I mention a panel sponsored by the AMS-MAA Committee on Employment and Educational Policy, to be held at the January 1991 Joint Mathematics Meetings in San Francisco, entitled "The Employment Process: How Can We Do Better?"

Edward A. Connors
Chair of AMS-MAA Data Committee and Chair of AMS-MAA Committee on Employment and Educational Policy
(Received September 9, 1990)

Policy on Letters to the Editor

Letters submitted for publication in *Notices* are reviewed by the Editorial Committee, whose task is to determine which ones are suitable for publication. The publication schedule normally requires from two to four months between receipt of the letter in Providence and publication of the earliest issue of *Notices* in which it could appear.

Publication decisions are ultimately made by majority vote of the Editorial Committee, with ample provision for prior discussion by committee members, by mail or at meetings. Because of this discussion period, some letters may require as much as seven months before a final decision is made. Letters which have been, or may be, published elsewhere will be considered, but the Managing Editor of *Notices* should be informed of this fact when the letter is submitted.

The committee reserves the right to edit letters.

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. All published letters must include the name of the author.

Letters should be typed and in legible form or they will be returned to the sender, possibly resulting in a delay of publication.

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

American Mathematical Society

Associate Executive Director

Position Open

The American Mathematical Society is seeking applications and nominations of candidates for an open position of Associate Executive Director of the Society.

Much has been written recently about concerns of maintaining the vitality of mathematics research in this country and renewing the mathematical sciences research enterprise. These concerns are often coupled with those indicating a need for reform in mathematics education. The Society is committed to lending its prestige and resources to assist in addressing these concerns. To this end, the Society is developing a plan of programmatic initiatives in the mathematical sciences.

The person filling this position will work in the Society's Providence office with the Executive Director and be responsible for the development and administration of the programmatic activities of the Society, as well as serving as Managing Editor of *Notices*. The Associate Executive Director will assist in all phases of these initiatives and, as such, will work with the AMS Board of Trustees, Council, committees, and staff; as well as governmental agencies, corporations and foundations, professional societies, and mathematicians throughout the world. As Managing Editor of *Notices*, the Associate Executive Director works closely with the Secretary of the Society and the *Notices* Editorial Committee.

The Society is seeking a candidate who is sensitive to the concerns of the mathematical research community and understands the need for involvement of research mathematicians in addressing the broad issues of the profession. Such a candidate should

- have earned a Ph.D. in one of the mathematical sciences
- have a good command of the English language and be capable of writing well and easily
- have an interest in administration and an ability to work harmoniously with mathematicians and nonmathematicians alike
- be familiar with national issues and activities that impact on the mathematics profession.

The initial appointment will be for two years and can be continued thereafter on an indefinitely renewable term or continuing basis.

Applications and nominations should be sent to:

Dr. William H. Jaco
Executive Director
American Mathematical Society
P.O. Box 6248
Providence, R.I. 02940

Completed applications and appropriate letters of reference received by 31 December 1990 will be assured of full consideration. It is desirable that duties begin as soon as possible and hopefully before 1 July 1991.

The Society is an equal opportunity employer and has a generous fringe benefit program including TIAA/CREF. Salary for the position will be commensurate with the background of the appointee.

ICM-90

Kyoto, Japan

Editor's Note: This article contains an overview of ICM-90 and brief discussions of the works of the Fields Medalists and the Nevanlinna Prize recipient.

ICM-90

The International Congress of Mathematicians, 1990, (ICM-90) was held from August 21-29, at the Kyoto International Congress Hall, Kyoto, Japan. The KICH is a modern building in the northern part of Kyoto, well designed for a large conference; it was crowded but not overwhelmed by the nearly four thousand mathematicians who attended. On opening day bus service was provided from the downtown hotels and on other days there was frequent charter bus service to and from the North Kyoto bus and subway terminal.

At the Opening Ceremony on August 21, Professor Hikosaburo Komatsu of the University of Tokyo took the chair as President of the Congress and welcomed the mathematicians to Japan. The Minister of Education of Japan, the Governor of Kyoto Prefecture, the Mayor of Kyoto, and the President of Kyoto University also addressed the meeting. It was announced that a special stamp memorializing the Congress had been printed and a representative of the Minister of Telecommunications presented the first sheet of stamps to President Komatsu. Two performances of traditional Japanese dance accompanied by musicians from Kyoto University were presented.

The climax of the opening ceremony was the award of the Fields Medals and the Nevanlinna Prize. Academician Ludwig Faddeev, President of the International Mathematical Union and Chairman of the Fields Medal Committee, announced that the medalists were:

VLADIMIR DRINFEL'D of the Physio-Technical Institute of Low Temperature Physics in Kharkov, for his work on quantum groups and for his work in number theory;

VAUGHAN JONES of the University of California, Berkeley, for introducing into knot theory some new polynomial invariants that grew out of his work on operator algebras;

SHIGEFUMI MORI of the Research Institute for Mathematical Sciences, Kyoto, for his work on the classification of 3-folds;

EDWARD WITTEN of the Institute for Advanced Study, Princeton, for his work connecting theoretical physics to modern mathematics.

László Lovász, Chairman of the Committee to award the Nevanlinna Prize, announced that the winner was

ALEXANDER RAZBOROV of the Steklov Institute, Moscow, for his proof that the number of and- and or- gates required to compute certain natural monotone Boolean functions grows faster than any polynomial in the number of arguments.

The prizes were then presented by the Minister of Education.

In the afternoon descriptions of the work of the prize winners were given. Joan Birman spoke about the work of Vaughan Jones, Michio Jimbo read Yuri Manin's appraisal of Drinfel'd's work, Heisuke Hironaka described Mori's contributions, Ludwig Faddeev discussed Witten's work, and László Lovász explained Razborov's. At the end of the day there was a reception in the Event Hall of the KICH that gave everyone a chance to meet and make friends.

The following days were filled with mathematics. There were 15 plenary talks given in the mornings and 145 sectional talks given in parallel sessions in the afternoons. It is a pleasure to report that no invited speaker failed to appear for political reasons. On the 29th, there were three plenary speakers followed by a brief closing ceremony at which Academician Faddeev reported on the meeting of the International Mathematical Union (IMU) which had taken place in Kobe on the 18th and 19th. The most important outcome of that meeting was that IMU had accepted the invitation of Switzerland, so that the next International Congress will take place

in Zurich in 1994. He also reported that the Emperor and Empress had received and congratulated the five prize winners at the Imperial Palace in Tokyo. Srishti Chatterji, the IMU delegate from Switzerland, invited everyone to come to Zurich in 1994. The Congress was formally adjourned by President Komatsu, who then invited all to attend a reception in the Event Hall.

There were 24 separate specialized conferences that met either just before or just after the Congress at various cities in Japan.

For accompanying members and mathematicians who wanted to take a break, there was a full supplementary program of tours to nearby points of interest, presentations of Japanese culture, and a concert of traditional music.

The entire Congress ran smoothly. For this we owe a great debt to the members of the Organizing Committee who worked hard for the last four years. From the opening ceremony through the munificent spread at the final party, our Japanese colleagues were most gracious and genial hosts.

Andrew M. Gleason
Harvard University

Vladimir Drinfel'd

Fields Medals

At the 1924 International Congress in Toronto, a resolution was adopted that at each international mathematical congress (two) gold medals should be awarded. Professor J. D. Fields, a Canadian mathematician who was secretary of the 1924 Congress, later donated funds establishing the medals which were named in his honor. Consistent with Field's wish that the awards should recognize both existing work and the promise of future achievement, it was agreed to restrict the medals to mathematicians not over forty years of age. In 1966, it was agreed that, in light of the great expansion of mathematical research in the world, up to four medals could be awarded at each congress.

Vladimir Drinfel'd

Vladimir Drinfel'd is a 36 year old mathematician. Symbolic of the renewed interchange between mathematics and physics, he is employed as a Senior Staff Member at the Physio-Technical Institute of Low Temperature Physics in Kharkov. Drinfel'd's interests can only be described as "broad." Not only do they span work in algebraic geometry and number theory, but his most recent ideas have taken a strikingly different direction: he has been doing significant work on mathematical questions motivated by physics, including the relatively new theory of quantum groups.

Drinfel'd defies any easy classification; it would be wrong to think of the works we have chosen to describe below as delimiting the profile of his mathematical interests. His breakthroughs have the magic that one would expect of a revolutionary mathematical discovery: they have seemingly inexhaustible consequences. On the other hand, they seem deeply personal pieces of mathematics: "only Drinfel'd could have thought of them!" But contradictorily they seem transparently natural; once understood, "everyone should have thought of them!"

Drinfel'd would enjoy his towering mathematical reputation had he been responsible for only one of his magnificent achievements. To be specific, let us mention Drinfel'd's encounter with the Langlands program. Drinfel'd solved Langlands' conjecture in a very special, but quite important case: GL_2 over function fields. In doing this, for example, he formulated the concept of an elliptic module. One feels that elliptic modules* should have been discovered by the great mathematicians of the 19^{th} century: they have already formed an important new branch of number theory with applications quite far from Langlands' enterprise.

Let X be a complete smooth algebraic curve over a finite field F_q admitting an F_q-rational point. Let K be the field of fractions of X. The Langlands conjecture asserts that there is a natural, one-one correspondence between (A) and (B):

*and, perhaps, Drinfel'd's more general theory of "Shtukas"

(A) Compatible families of irreducible l-adic N-dimensional representations of $\mathrm{Gal}(\overline{K}/K)$. Here compatible family means that you give an irreducible l-adic N-dimensional representation for each prime number l not dividing q, and these representations for different prime number l are required to have the property that the trace of any Frobenius element must be independent of l in an appropriate sense.

(B) Cuspidal automorphic representations of GL_N over K.

The "one-one correspondence" between (A) and (B) is expected to be natural in the sense that the theory of L-functions and the "ϵ-factors" for (A) and for (B) are supposed to correspond. Before Drinfel'd's work, we had (thanks to Grothendieck, Langlands, and Deligne) a way of passing from (A) to (B), for $N = 2$. It was a complete mystery how to pass from (B) to (A). By Drinfel'd's theory we now can go from (B) to (A) in the function field case.

With a completely different and utterly ingenious argument (his vanishing cycles theorems), Drinfel'd was able to go from (A) to (B) in case $N = 2$, even if he were given just one and not a "compatible family" of irreducible l-adic (2-dimensional) representations of $\mathrm{Gal}(\overline{K}/K)$. This completely settled the Langlands conjecture for $N = 2$, with a vengeance! As an immediate by-product, Drinfel'd finds that any single, irreducible l-adic 2-dimensional representation of $\mathrm{Gal}(\overline{K}/K)$ occurs, after twist by a character, as a member of a compatible family of representations, and also yields the Ramanujan conjecture for cuspidal automorphic representations of GL_2 over function fields.

In the course of his work, Drinfel'd constructs the so-called Drinfel'd modular curves (and varieties) over X, as moduli spaces of elliptic modules. By studying the analytic properties of these modular curves (especially the p-adic analytic uniformization of them), Drinfel'd discovered his "upper-half-plane" and was led to develop his deep ideas concerning p-adic uniformization and the strange phenomenon known as the "Drinfel'd switch," where one can understand the "bad fibre" of a Shimura variety at a prime p, by understanding the bad fibre of another totally different Shimura variety at another prime q. This is used in an essential way by Ribet in his recent work on the Serre conjectures.

Finally, we should mention Drinfel'd's pioneering work with Manin on the construction of instantons. These are solutions to the Yang-Mills equations which can be thought of as having particle-like properties of localization and size. Using ideas from algebraic geometry, they complemented the work of Ward, Atiyah, and Hitchin to give explicit solutions for the "self-dual" equations. At the time it was believed that no other solutions existed, but recently Uhlenbeck and the Sibners have found non-self-dual solutions. Drinfel'd's interests in physics continued with his investigation of the Yang-Baxter equations with Belavin. Ultimately, this lead to Drinfel'd's constructing representations of the algebras associated with classical quantum groups, a field in which he has been a consistent leader.

Arthur Jaffe
Barry Mazur
Harvard University

Vaughan F. R. Jones

In 1983 Vaughan Jones provided a startling discovery within the context of von Neumann algebras. Not only did his work open up entirely new directions within that subject, but it was to have a profound effect on knot theory and exhibit strong connections with the study of Hecke algebras, quantum statistical mechanics, quantum field theory and the prediction of DNA configurations in certain biological interactions. One aspect of the connection to physics was made by Witten, [11], who has shown that some of the more recent developments on knots can be interpreted within the context of topological quantum field theory.

Vaughan F. R. Jones

The original motivation of Jones's work, [4], was to provide an analysis of subfactors of a II_1 factor.

Factors of type II_1 were discovered by Murray and von Neumann. They are weakly closed, star algebras of operators on a Hilbert space, with center consisting of the scalars and supporting a finite, positive, trace functional. Such a factor provides a scale by which to measure the relative dimension of the Hilbert space, H, on which it acts. We write this number as $\dim_N(H)$. In this case there are no restrictions on the number. Indeed it may vary continuously from 0 to ∞. Jones varied this idea and looked at a pair of factors, $N \subset M$ considering the dimension of M relative to its subfactor N. This he defined as $[M : N] = \dim_N(H)/\dim_M(H)$, showing it to be independent of the Hilbert space. The importance of this idea became evident in the restrictions found on the index. The allowable set of indices is precisely $\{4\cos^2(\pi/n), n \geq 3\}$ and the interval $[4, \infty]$. Moreover, each of these instances was shown to occur for the hyperfinite factor, a fundamental object in the theory. Many questions arose immediately. Before this work, classification of subfactors of a given factor seemed quite out of reach. Yet a vast amount of progress has been made on this problem. By analogy with the theory of crossed products it is natural to ask what, if any, additional restrictions occur if we ask that $N' \cap M = \mathbb{C}I$ (If M is the crossed product of N by a finite group action, this is asking for the action to be free.) While this condition is automatic in the discrete range given above, it is not in the continuous range. Again this is an object of much study and substantial progress.

To understand the connection with knot theory we consider the "basic construction". Consider N and M acting on $L^2(M)$, the Hilbert space of M formed using the trace, $tr(\cdot)$. There one finds the projection e_N onto the Hilbert space $L^2(N)$. In essence this is the only given information. Now form the factor $M_1 =< M, e_N >$ generated by M and e_N. It turns out that $[M_1 : M] = [M : N]$ and $tr(e_N) = 1/[M : N]$, as long as the index is finite. The idea now is to continue the construction, obtaining a tower of algebras and a sequence of projections $\{e_i\}$, with the following property:

$$e_i e_{i\pm1} e_i = \tau e_i, \text{ where } \tau = [M : N]^{-1}$$

$$\text{and } e_i e_j = e_j e_i, \text{ if } |i - j| \geq 2.$$

The algebra M_n in the tower possesses a trace extending that on M_{n-1} and satisfying the Markov condition

$$tr(e_n x) = \tau tr(x), \quad x \in M_{n-1}.$$

The next point is to define $g_i = qe_i - (1 - e_i)$ where $2 + q + q^{-1} = [M : N]$. We have

$$(1) \qquad g_i g_j = g_j g_i, \quad \text{if } |i - j| \geq 2,$$

$$(2) \qquad g_i g_{i+1} g_i = g_{i+1} g_i g_{i+1},$$

$$(3) \qquad g_i^2 = (q - 1)g_i + q,$$

$$(4) \qquad g_i g_{i+1} g_i + g_i g_{i+1} + g_{i+1} g_i + g_i + g_{i+1} + 1 = 0.$$

Thus within the $\{e_i\}$-algebra, $\{1, e_1, e_2, \dots\}$, we see the presence of a quotient of the Hecke algebra, $H(q, n)$ (defined by relations (1), (2), and (3) for $i = 1, 2, \dots, n - 1$). Having $H(q, n)$ we also have a representation of the n-string braid group. Now each knot or link arises as the closure of a braid. Moreover there is a similarity between the defining properties of the trace and its Markov property in this setting with Markov moves on braids. As the latter gives link equivalence, Jones was led to look for a link invariant using the Markov trace on the $\{e_i\}$-algebra. He was able to construct the "Jones polynomial", $V_L(t)$, a Laurent polynomial associated to each oriented link. It then appeared that knowledge gathered from understanding the algebraic situation oft times translates into information about knots, e.g., knowing the number of strings required to represent a knot, [7].

Other algebras yielded other invariants via this route including the two variable polynomial which specializes to both the Alexander and Jones polynomial. Interestingly enough this last was arrived at separately by specialists in knot theory and in operator algebras.

In [5], Jones provides detailed information about representations of the braid group arising from the Hecke algebras of type A. Moreover, a penetrating analysis of the two-variable and Jones polynomials appears there, including discussion of connected sums, reversing orientation, and mirror images. It is in this paper that a connection is pointed out with work in statistical mechanics, in particular the Potts model.

Kauffman brought in further ideas from statistical mechanics by constructing a "states" model of the Jones polynomial, [10]. Jones extended this idea, but he opened [9] a whole new direction upon realizing that under certain conditions solutions of the Yang-Baxter equations could be used for constructing invariants of links. These equations arise, in particular, in Baxter's treatment [1,6] via transfer matrices of exactly solvable models. There they depend on a parameter, the spectral parameter, which we include as a superscript. The equations are

$$R_i R'_{i+1} R''_i = R''_{i+1} R'_i R_{i+1},$$

$$R_i R'_j = R'_j R_i \quad |i - j| \geq 2.$$

One immediately notes a similarity with the braid group relations. This brought another direction into play, *viz.*, quantum groups. The theory of quantum groups, non-commutative and non-cocommutative Hopf algebras, was devised by Jimbo and Drinfel'd to produce

solutions of the Yang-Baxter equations. Eventually it was seen that every irreducible representation of a simple Lie algebra led, via this method, to a link invariant.

In the setting of quantum field theory some recent work has focused on the study of superselection sectors with braid group statistics. In this context, Markov traces have arisen as well. All of this comes from considering a lower dimensional version of the theory of superselection sectors of Doplicher, Haag and Roberts.

Vaughan Jones has shown himself to be a mathematician of enormous vision and originality. His work has influenced many and we look forward, with anticipation, to future contributions.

Richard H. Herman
University of Maryland

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Shigefumi Mori

Professor Shigefumi Mori was born February 23, 1951 in Nagoya, Japan. He received his BA (1973), MA (1975) and Ph.D (1978) from Kyoto University, Japan. He worked at Kyoto University (1975-1980), Nagoya University (1980-1990) and is currently at the Research Institute for Mathematical Sciences at Kyoto. He held visiting positions at Harvard University, the Institute for Advanced Study, Max-Planck Institute and Columbia University. Since 1987 he has spent one quarter of every academic year at the University of Utah.

Shigefumi Mori

Mori has received several prizes in Japan in recognition of his mathematical works: Yanaga Prize (1983), Chunichi Culture Prize (1984), Japanese Mathematical Society Prize (1988), Inoue Prize (1989), and Japan Academy Prize (1990). He also received the Frank Nelson Cole Prize of the American Mathematical Society in 1990.

Mori's main research interest is the study of higher dimensional algebraic varieties. Algebraic curves, that is, compact Riemann surfaces, were well understood in the XIXth century. In dimensions two and higher, the classical approach to understanding varieties has been to begin to study a variety X by trying to find a variety Y such that Y is obtained from X by some understandable "surgery operations" and so that Y is "simpler" than X. The strategy is to understand X by first studying the "simpler" variety Y and then analyzing the "surgery operations".

The "surgery operations" necessary to this program occur in the context of what is called "bimeromorphic equivalence". Two algebraic varieties (or compact complex manifolds) X and Y are said to be bimeromorphic if there is a (partially defined) map $f : X \to Y$ such that both f and f^{-1} are meromorphic.

In dimension two, one can define "simpler" in topological terms: If X and Y are bimeromorphic, then Y

is "simpler" than X if the second Betti numbers satisfy the inequality $b_2(Y) < b_2(X)$. However this is not the conceptually correct definition in general.

The two fundamental results of complex 2-dimensional geometry are the following:

1. Any bimeromorphic map between 2-dimensional compact complex manifolds is the composite of a single elementary step (called blowing up) and inverses of blowing ups (called blowing down).

2. For any surface X, either a) there is a unique Y bimeromorphic to X which is the "simplest" among those bimeromorphic to X, or b) one can give a complete structure theory for X. These results were proved around the turn of the century by the Italian school of algebraic geometry.

Before Mori's pioneering work, it was generally believed that the study of three-dimensional algebraic varieties was hopelessly complicated and that there was no possibility of understanding them. In 1978, Mori devised a completely new way to produce non-trivial maps of the complex projective line into algebraic varieties and realized that this technique was central to the generalization of classification theory for curves and surfaces to varieties of arbitrary dimension. In higher dimension there should be several series of elementary bimeromorphic maps in 1 above. Also, the "simplest" variety Y (as in 2a) is slightly singular and is not completely unique. (In many applications, however, these singularities cause only minor technical difficulties.)

After ten years of work, Mori solved the three-dimensional problem completely in 1989. (The higher dimensional case is still very much open.) It is this outstanding achievement that was recognized by the International Mathematical Union.

C. Herbert Clemens
János Kollár
University of Utah

Edward Witten

Edward Witten (born 1951) is a Professor at the Institute for Advanced Study at Princeton. Over the last decade, while exploring the use of advanced mathematical tools in theoretical physics, he has shown a unique talent in applying physical ideas to discover new and beautiful mathematics.

Witten's first major mathematical contribution was a new proof of the positive energy theorem of Schoen and Yau for the Einstein equations. The proof, which appeared in 1981, employed in a subtle way the idea of supersymmetry. This became the centerpiece of many of Witten's subsequent works, like the fundamental 1982 paper "Supersymmetry and Morse Theory".

Given a Morse function h on a Riemannian manifold M, Witten considered the de Rham complex of M where the exterior differential is conjugated by e^{-th}, with t a positive real number. As t goes to infinity, the support of the harmonic forms shrinks to the critical points of h. This picture led to a new proof of the Morse inequalities and of the description of the cohomology of M in terms of the critical points and the gradient flow between them. Floer would later use such a definition of cohomology in a situation where no traditional device was available. This paper also influenced Laumon's work on the geometric Fourier transform in positive characteristic. Furthermore, it was one of the first papers to use supersymmetry and geometry of the loop space in the study of the index of differential operators. Since then these notions have become very central in differential geometry. In the same vein, Witten subsequently gave a string theory interpretation of the elliptic genus and provided arguments for its rigidity which led to the proofs of this property by Taubes and Bott-Taubes.

Edward Witten

Another piece of new mathematics stemmed from Witten's papers on global gravitational anomalies. He discovered that the holonomy of the determinant line bundles of families of Dirac operators is given by certain eta invariants. The full proof and further developments were due to Bismut-Freed, Cheeger and Bismut-Cheeger.

In recent years, Witten focused his attention on topological quantum field theories. These correspond to Lagrangians such that the associated Feynman functional integrals are metric-independent, formally giving man-

ifold invariants. Witten described in those terms the invariants of Donaldson and Floer (extending the earlier ideas of Atiyah) and generalized the Jones knot polynomial to the case of an arbitrary ambiant 3-manifold M. In the latter case, given a compact simple Lie group G, he considered the Chern-Simons Lagrangian leading to functional integrals over connections in a fixed G-bundle over M, with the integrand dependent on the choice of a knot in M. Though the integrals are formal, they may be rewritten as explicit mathematical quantities using knot surgery on M and the 2-dimensional conformal field theory related to affine Lie algebras and quantum groups. When $G = SU(2)$ and $M = S^3$, one recovers the Jones polynomial. In the case of $G = SU(2)$ and M general, Reshetikhin-Turaev, within their own approach to these invariants, proved their independence of the choice of surgeries.

Last year, the relentless exploration of mathematics $\cap$ physics led Witten to a prediction, verified up to genus 3, of the stable intersection numbers on moduli spaces of curves. His conjecture postulated the equality of the topological and combinatorial versions of 2-dimensional quantum gravity theory and related the intersection numbers to an asymptotic behavior of the numbers of surface triangulations, found recently by other physicists to be governed by the KdV flows.

Although mostly not in the form of completed proofs, Witten's ideas have triggered major mathematical developments by the force of their vision and their conceptual clarity, his main discoveries soon becoming theorems. His Fields Medal at the 1990 International Congress of Mathematicians acknowledged the growing impact of his work on contemporary mathematics.

Krzysztof Gawędzki
Christophe Soulé
Institut des Hautes Études Scientifiques

Nevanlinna Prize

The University of Helsinki has granted funds to award a Nevanlinna Prize in the mathematical aspects of information science to a young mathematician, to be given at the International Congress of Mathematicians. The Nevanlinna Prize was first awarded in 1982.

Alexander Razborov

In a beautiful series of papers, Alexander Razborov solved a number of outstanding problems in circuit complexity, a notoriously difficult branch of complexity theory. The central problem of complexity theory is to determine the number of steps (or the amount of memory) necessary to compute various functions. The best known version of this problem is the P versus NP question. It asks whether there are polynomial time algorithms for certain computational tasks which seem to require exhaustive search. In 1985, Razborov, then a student at Moscow University and unknown to researchers in the West, obtained a major breakthrough by settling a monotone analog to the P versus NP question.

Alexander Razborov

Razborov developed a brilliant new technique for analyzing computation on the Boolean circuit model. A *Boolean circuit* is an acyclic network of gates which represent Boolean functions from a basis such as AND, OR, or NOT. Any Boolean function computable in polynomial time is definable by a family of circuits over this basis whose size is polynomial in the input length. It may thus be possible to show that a function is not computable in polynomial time by showing that it requires circuits of superpolynomial size. Though this remains beyond our present ability, a number of workers have succeeded in establishing such bounds for restricted classes of circuits.

A *monotone* circuit is over the basis AND and OR, without NOT. Razborov proved that such circuits require superpolynomially many gates to test whether a graph has a *clique*, *i.e.*, a complete subgraph, of a specified size. To appreciate the magnitude of this contribution, consider that the best prior lower bound for monotone circuits was not even superlinear. An obstacle to proving lower

bounds on circuit size is that for any given circuit the intermediate functions computed by sub-circuits may be extremely difficult to grasp. Razborov introduced the method of approximation to overcome this. In his method the AND and OR operations are adjusted slightly so that the intermediate functions remain manageable. Each adjustment changes the output of the circuit in only a small way. Yet, after all adjustments have been made, the resulting function differs greatly from the original function. Hence there must have been many adjustments, and therefore many gates.

Razborov also applied this method to the *bounded-depth* circuit model. Earlier work on this model by Ajtai, Furst-Saxe-Sipser, Yao, and Hastad showed that under the basis AND, OR, and NOT, circuits of significantly less than logarithmic depth require superpolynomial size to compute the parity of the input string. Using the approximation method, Razborov sharply improved and simplified this result to prove similar bounds over AND, OR, and PARITY for the function which tests whether there are a majority of 0's or a majority of 1's in the input string.

It is early to say whether Razborov's approximation method will be the key to general circuit lower bounds and the P versus NP question. In one of his other results he gives a monotone circuit lower bound for the *matching* function, *i.e.*, testing whether a graph has a collection of disjoint edges of a specified size. The proof of this theorem is quite similar to the lower bound for the clique function. But, since the matching function is computable in polynomial time, this indicates that the approximation method may not be getting at the heart of the difficulty of the clique function. In a later paper, Razborov considers two forms of the approximation method. He shows that the weaker form is insufficient for proving lower bounds on the general circuit model. On the other hand the stronger form is universal for general circuit lower bounds, in the sense that it must give a bound which is close to the correct one. Whether the technical obstacles which arise when trying to apply this method can be met, only time will tell.

Michael Sipser
Massachusetts Institute of Technology

LIE ALGEBRAS AND RELATED TOPICS

Georgia Benkart and J. Marshall Osborn, Editors

Contemporary Mathematics, Volume 110

The 1984 classification of the finite-dimensional restricted simple Lie algebras over an algebraically closed field of characteristic $p > 7$ provided the impetus for a Special Year of Lie Algebras, held at the University of Wisconsin, Madison, during 1987-88. Work done during the Special Year and afterward put researchers much closer toward a solution of the long-standing problem of determining the finite-dimensional simple Lie algebras over an algebraically closed field of characteristic $p > 7$.

This volume contains the proceedings of a conference on Lie algebras and related topics, held in May 1988 to mark the end of the Special Year. The conference featured lectures on Lie algebras of prime characteristic, algebraic groups, combinatorics and representation theory, and Kac-Moody and Virasoro algebras. Many facets of recent research on Lie theory are reflected in the papers presented here, testifying to the richness and diversity of this topic.

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1990 Annual AMS-MAA Survey

(First Report)

Report on the 1990 Survey of New Doctorates, *Donald E. McClure*
Salary Survey for New Doctorates
Faculty Salary Survey
Doctoral Degrees Conferred, 1989–1990

This first report on the 1990 Survey includes a report on the 1990 survey of new doctorates, a report on salaries of new doctorates, salary data on faculty members in four-year colleges and universities, and a list of names and thesis titles for members of the 1989-1990 Ph.D. class. The report is based on information collected from questionnaires distributed in May to departments in the mathematical sciences in colleges and universities in the United States and Canada, and later to the recipients of doctoral degrees granted by these departments between July 1989 and June 1990, inclusive. A further questionnaire was distributed in September, concerned with data on fall enrollments, majors, and departmental size. This data will appear in the second report on the 1990 Survey, in a spring 1991 issue of *Notices*.

For these reports, departments are divided into groups according to the highest degree offered in the mathematical sciences. The groups are described in the box below.

The 1990 Annual AMS-MAA Survey represents the thirty-fourth in an annual series begun in 1957 by the Society. The 1990 Survey is under the direction of the AMS-MAA Data Committee whose members are Edward A. Connors (chair), Lincoln K. Durst (consultant), John D. Fulton, James F. Hurley, Charlotte Lin, Don O. Loftsgaarden, David J. Lutzer, James W. Maxwell (ex officio), Donald E. McClure, and Donald C. Rung. Comments or suggestions regarding this Survey may be directed to the committee.

Groups I and II include the leading departments of mathematics in the U.S. according to the 1982 assessment of Research-Doctorate Programs conducted by the Conference Board of Associated Research Councils in which departments were rated according to the quality of their graduate faculty. 1

Group I is composed of 39 departments with scores in the 3.0-5.0 range

Group II is composed of 43 departments with scores in the 2.0-2.9 range.

Group III contains the remaining U.S. departments reporting a doctoral program.

Group IV contains U.S. departments (or programs) of statistics, biostatistics and biometrics reporting a doctoral program.

Group V contains U.S. departments (or programs) in applied mathematics/applied science, operations research and management science which report a doctoral program.

Group Va is applied mathematics/applied science; **Group Vb** is operations research and management science.

Group VI contains doctorate-granting departments (or programs) in the mathematical sciences in Canadian universities.

Group M contains U.S. departments granting a master's degree as the highest graduate degree.

Group B contains U.S. departments granting a baccalaureate degree only.

1 These findings were published in *An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences*, edited by Lyle V. Jones, Gardner Lindzey, and Porter E. Coggeshall, National Academy Press, Washington, D.C., 1982. The information on mathematics, statistics and computer science was presented in digest form in the April 1983 issue of *Notices*, pages 257-267, and an analysis of the above classifications was given in the June 1983 *Notices*, pages 392-393. For a listing of departments in Groups I and II see April 1988 *Notices*, pages 532-533.

Highlights

1. 933 doctorates in the mathematical sciences were awarded by U.S. institutions in the period July 1, 1989 through June 30, 1990. This is an increase of 3 percent over last year and is 15 percent greater than the average of the fall counts for the last four years.

2. 401 U.S. citizens are reported to have received doctorates in the mathematical sciences. This is 43 percent of the total awarded by U.S. institutions, the lowest percentage ever reported. In part, the low percentage is explained by the relatively high numbers of new doctorates awarded to non-U.S. citizens. The number of U.S. citizens receiving doctorates is slightly lower than the number reported last year, and still strikingly lower than the numbers reported up to the early 1980s, but it remains more than 10 percent above the record low numbers reported in 1986-87 and 1987-88.

3. 22 percent of the U.S. citizen doctorates were awarded to women, less than the historical high of 24 percent in 1988-89, and equal to the percentage awarded to women over the preceding four years.

4. 17 percent of the new doctorates hired in U.S. doctorate-granting departments were women, while 18 percent of the new doctorates (regardless of citizenship) were women.

5. 4 of the 401 U.S. citizen doctorates were black. The higher number (9) reported in 1988-89 apparently does not signal a trend of increased representation of blacks among new doctorates.

6. The median starting salary of new doctorates reporting teaching (or teaching and research) was $32,000 for men and $32,500 for women.

Report on the 1990 Survey of New Doctorates

Donald E. McClure

This report presents a statistical profile of new doctorates in the mathematical sciences awarded by universities in the United States and Canada during the period July 1, 1989, through June 30, 1990. It includes the employment status of recipients of 1989-90 doctorates in the mathematical sciences (as of October 5, 1990), an analysis of the data by sex, racial/ethnic group and citizenship, and reports trends in the number of doctoral degrees for each of Groups I through V (see box on preceding page for description of groups). Table 1 provides the response rates for the 1990 Survey of New Doctorates.

TABLE 1: Response Rates

Group I	39 of 39
Group II	41 of 43 including 2 with 0 degrees
Group III	75 of 86 including 18 with 0 degrees
Group IV	54 of 74 including 6 with 0 degrees
Group Va	9 of 16
Group Vb	18 of 33 including 4 with 0 degrees
Group VI	18 of 30 including 4 with 0 degrees

Doctorates Granted

The number of new doctorates reported in 1989-90 by U.S. and Canadian mathematical sciences departments is 991. Table 2A gives the fall counts for the past five Annual Surveys. This year's fall count will be updated in the Second Report of the 1990 Survey, to appear in a spring 1991 issue of *Notices*. Table 2B reports for comparison the fall and spring counts in the years 1985-86 through 1988-89.

Table 2A: New Doctorates, Fall Counts

	85-86	86-87	87-88	88-89	89-90
U.S.	756	779	804	905	933
Canada	45	66	52	53	58
Total	801	845	856	958	991

Table 2B: New Doctorates, Fall and Spring Counts

	85-86		86-87		87-88		88-89		89-90	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
U.S.	756	782	779	808	804	828	905	919	933	*
Canada	45	45	66	66	52	55	53	62	58	*
Total	801	827	845	874	856	883	958	981	991	*

* To appear in a spring 1991 issue of *Notices*.

In Table 2C we record the number of new doctorates in the mathematical sciences in the U.S. from the years 1985-86, exclusive of Group Vb. The response rate for Group Vb, which includes departments in engineering and management science, is the lowest of all groups.

Table 2C: New Doctorates Awarded by Groups I-Va

	85-86	86-87	87-88	88-89	89-90
I-Va	698	743	760	854	864**

** This is a fall count. The other entries in Table 2C are spring counts. Table 2C will be updated to include a spring count for 1989-90 in a spring 1991 issue of *Notices*.

Employment Status of New Doctorates, 1989-1990

Table 3A shows the employment status, by type of employer and field of degree, of the 991 recipients of doctoral degrees conferred by the mathematical sciences departments in the U.S. and Canada between July 1, 1989, and June 30, 1990. The names of these individuals are listed with their thesis titles in a later section of this First Report of the 1990 Annual Survey. Again this year we present the employment status of the 183 women new doctorates in Table 3B. The employment information was obtained initially from the departments granting the degrees and subsequently from data provided by the degree recipients themselves.

The first five rows of Table 3A give the numbers of new doctorates who have accepted appointments in U.S. doctorate-granting mathematical sciences departments (Groups I-V). The next two rows give the numbers who have accepted appointments in mathematical sciences departments granting masters and bachelors as the highest degrees.

There was an increase in the number of new doctorates hired in Groups I-V (259 compared to 240 last year and 207 two years ago). Most of the increase occurred among Group III departments. The number hired by Group I departments is essentially the same as last year, and still over 40 percent above the levels reported in 1986-87 and 1987-88. Excluding those whose employment status is unknown, 28 percent of the men and 25 percent of the women new doctorates accepted appointments in Group I-V departments.

Most new doctorates accepted academic positions. Of the 678 new doctorates employed in the U.S., 66 percent (446) assumed positions in university or four-year college mathematical sciences departments, a two percentage point decrease from last year. Sixteen percent (107) assumed positions in government, business and industry, a fraction of a percentage below last year. The marginal decreases in these percentages do not reflect reductions in total employment in these sectors; instead, they are due to increased employment overall weighted towards other types of employers, for example, research institutes and other academic departments.

Table 3A shows as "not yet employed" about 5.7 percent of the 1989-90 new doctorates, excluding those whose employment status is unknown. At the same time last year, 6.8 percent of the 1988-89 new doctorates were reported as "not yet employed". The data in Table 3A were obtained in many instances early in the summer of 1990 and do not reflect subsequent hiring; an update of Table 3A is planned for the Second Report in a spring 1991 issue of *Notices*. In a similar update last year, the percentage of 1988-89 new doctorates who had reported not finding employment was 3.1 percent (see *Notices*, November 1989, page 1157, and July/August 1990, page 660).

Table 3A: Employment Status of 1989-1990 New Doctorates in the Mathematical Sciences

Type of Employer	Algebra or Number Theory	Real or Complex Analysis	Geometry or Topology	Logic	Probability or Statistics	Applied Mathematics	Discrete Mathematics or Combinatorics	Numerical Analysis	Linear or Nonlinear Optimization	Other	T
Group I	19	26	39	1	2	4	4	4		2	101
Group II	12	7	7		3	9	5	2		1	46
Group III	7	7	10	3	9	17	3	4	1	2	63
Group IV					30				1		31
Group V					4	9	2		1	2	18
Masters	12	12	9	3	22	12	6	1	2	3	82
Bachelors	22	12	12	6	17	20	10	2		4	105
Two-year Colleges	1	1	2		1	2		1		1	9
Other Academic Departments	5	5	4	1	34	18	2	3	5	7	84
Research Institutes	2	4	7		7	8	1	1	1	1	32
Government	1	1			9	4			1	1	17
Business and Industry	2	4	2	2	51	13	4	6	2	4	90
Canada, Academic	7	2	2	1	9	6	6	1	2	2	38
Canada, Nonacademic					7	2			1		10
Foreign, Academic	12	19	10	5	46	26	6	6	3	9	142
Foreign, Nonacademic	1		2		5	2					10
Not seeking employment	1		1		5	1	1	2	1		12
Not yet employed	8	8	5	1	11	10	4	2	3	2	54
Unknown	2	6	6	2	10	7	3		2	9	47
Total	114	114	118	25	282	170	57	35	26	50	991

Table 3B: Employment Status of 1989-1990 New Doctorates in the Mathematical Sciences Females Only

Type of Employer	Algebra or Number Theory	Real or Complex Analysis	Geometry or Topology	Logic	Probability or Statistics	Applied Mathematics	Discrete Mathematics or Combinatorics	Numerical Analysis	Linear or Nonlinear Optimization	Other	Total
Group I	1	2	7			1	1				12
Group II	3		2		2		1				8
Group III	1	1	2			5		1		1	11
Group IV					9						9
Group V					1		1			2	4
Masters		2	2	1	3	2	4			2	16
Bachelors	3	2	5	1	2	4				2	19
Two-year Colleges					1	1		1		1	4
Other Academic Departments	2				10	6				3	21
Research Institutes					2					1	3
Government					2						2
Business and Industry		1			9	4		1		1	16
Canada, Academic	2			1	3	1	1				8
Canada, Nonacademic					2						2
Foreign, Academic	3	2	1	1	6	6		1		1	21
Foreign, Nonacademic											
Not seeking employment			1		2		1	2			6
Not yet employed	1		1		4	2		2	1		11
Unknown	1	2			4	2				1	10
Total	17	12	21	4	62	34	9	8	1	15	183

TABLE 4: Sex, Racial/Ethnic Group, and Citizenship of New Doctorates

July 1, 1989 - June 30, 1990

U.S. DEGREES	MEN					WOMEN					TOTAL
RACIAL/ETHNIC GROUP	CITIZENSHIP				Total Men	CITIZENSHIP				Total Women	
	U.S.	Canada	Other	Not Known		U.S.	Canada	Other	Not Known		
Asian, Pacific Islander	13	1	255	1	270	10		52		62	332
Black	3		6		9	1				1	10
American Indian, Eskimo, Aleut	2				2						2
Mexican American, Puerto Rican, or other Hispanic	5		29		34	3		1		4	38
None of those above	276	7	127		410	72	1	25		98	508
Unknown	13	1	21	2	37	3		2	1	6	43
Total	312	9	438	3	762	89	1	80	1	171	933

CANADIAN DEGREES	MEN					WOMEN					TOTAL
RACIAL/ETHNIC GROUP	CITIZENSHIP				Total Men	CITIZENSHIP				Total Women	
	U.S.	Canada	Other	Not Known		U.S.	Canada	Other	Not Known		
Asian, Pacific Islander		3	2	1	6		3			3	9
Black							1			1	1
American Indian, Eskimo, Aleut											
Mexican American, Puerto Rican, or other Hispanic											
None of those above	1	23	5	1	30		1	2		3	33
Unknown		9	1		10	1	4			5	15
Total	1	35	8	2	46	1	9	2		12	58

Sex, Racial/Ethnic Group, and Citizenship of New Doctorates, 1989-1990

Table 4 presents a breakdown according to sex, racial/ethnic group, and citizenship of the new doctorates. The information reported in this table was obtained from departments granting the degrees and in some cases from the recipients themselves.

Of the 933 doctorates awarded by U.S. universities, the citizenship is reported as known for 929 recipients, with 401 reporting U.S. citizenship. Thus, only 43 percent of the doctorates awarded by U.S. institutions went to U.S. citizens. This is a record low for the percentage of U.S. citizens since citizenship data started being reported in 1973-74.

Two factors are reflected in the low percentage of U.S. citizens: (1) the number of U.S. citizens receiving doctorates remains low, down from last year and barely over 400 for only the second time in the past six years, and (2) the number of non-U.S. citizens receiving doctorates has been increasing (528 this year compared to 473 last year and 435 two years ago). Refer to Table 5 and the accompanying graphs.

Among the U.S. citizens receiving doctorates in the mathematical sciences, 4 were black (3 men, 1 woman) and 8 were Mexican American, Puerto Rican or other Hispanic (5 men, 3 women).

Women comprise 22 percent of the U.S. citizens receiving doctorates in the mathematical sciences, equal to the percentage of U.S. citizen doctorates granted to women over the preceding four years. The numbers of U.S. citizen women receiving doctorates in the mathematical sciences have been quite stable for the last nine years, except for a dip in 1986-87 and 1987-88. The increased percentage of women from the levels of ten or more years ago mainly reflects the decline in the number of U.S. citizen men receiving doctorates. Table 6 presents data for the period 1973-74 through 1989-90.

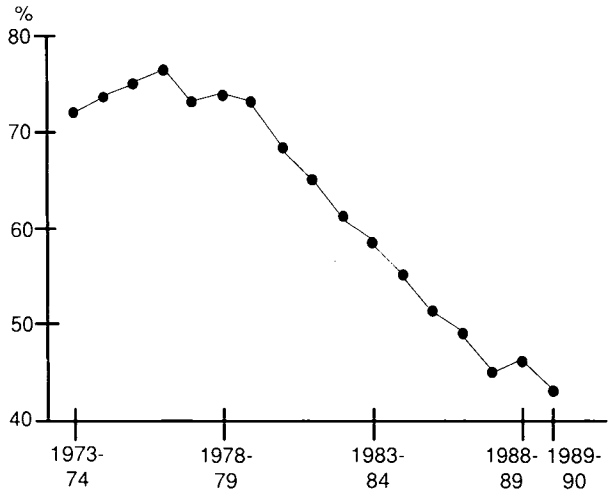
Citizenship and Sex of U.S. Doctorates, 1973 to 1990

Again this year, information is presented on the annual number of doctorates granted by U.S. universities to U.S. citizens since 1973 (Table 5). This number is divided into male and female doctorates (Table 6). In Table 5 the column headed "Adjusted Total of Doctorates given by U.S. Universities" gives the number of doctorates granted between July 1 and June 30 of the indicated years *whose citizenship is known*. Column 2 gives the number who are U.S. citizens and column 3 the percentage that this represents. In Table 6 the number in column 2 of Table 5 is further divided into men and women. Note that in both tables *all years prior to 1982-83* include doctorates granted by computer science departments.

TABLE 5: U.S. Citizen Doctorates

	Adjusted Total of Doctorates given by U.S. universities	Total of Doctorates who are U.S. citizens	%
1973-1974	938	677	72
1974-1975	999	741	74
1975-1976	965	722	75
1976-1977	901	689	76
1977-1978	868	634	73
1978-1979	806	596	74
1979-1980	791	578	73
1980-1981	839	567	68
1981-1982	798	519	65
1982-1983	744	455	61
1983-1984	738	433	59
1984-1985	726	396	55
1985-1986	755	386	51
1986-1987	739	362	49
1987-1988	798	363	45
1988-1989	884	411	46
1989-1990	929	401	43

Graph for Table 5: U.S. Citizen Doctorates
Total of Doctorates by Percent



Graph for Table 5: U.S. Citizen Doctorates

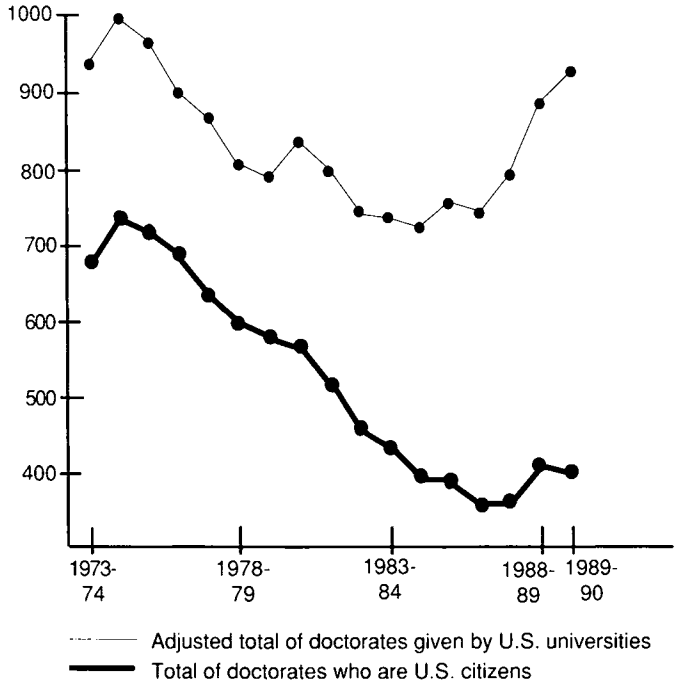


TABLE 6: U.S. Citizen Doctorates, Male and Female

	Doctorates who are U.S. citizens	Male	Female	% Female
1973-1974	677	618	59	9
1974-1975	741	658	83	11
1975-1976	722	636	86	12
1976-1977	689	602	87	13
1977-1978	634	545	89	14
1978-1979	596	503	93	16
1979-1980	578	491	87	15
1980-1981	567	465	102	18
1981-1982	519	431	88	17
1982-1983	455	366	89	20
1983-1984	433	346	87	20
1984-1985	396	315	81	20
1985-1986	386	304	82	21
1986-1987	362	289	73	20
1987-1988	363	287	76	21
1988-1989	411	313	98	24
1989-1990	401	312	89	22

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Salary Survey for New Recipients of Doctorates, 1989-1990

The figures for 1990 were compiled from questionnaires sent to individuals who received a doctorate in the mathematical sciences during the 1989-90 academic year from universities in the United States and Canada.

Questionnaires requesting information on salaries and professional experience were distributed to 820 recipients of degrees using addresses provided by the departments granting the degrees. Of these, 11 were returned by the postal service as undeliverable and could not be forwarded. There were 421 individuals who returned forms between late June and mid-September. The tables below are based on the responses from 367 of these individuals (297 men and 70 women). Data from 54 responses were not used in the compilation of the tables below; forms with insufficient data, or from individuals who indicated they had part-time employment, were not yet employed, or were not seeking employment, were considered unusable.

Readers should be warned that the data in this report are obtained from a self-selected sample and inferences from them may not be representative of the population. For more comprehensive information on the recipients of new doctorates granted last year in the mathematical sciences in the U.S. and Canada, see the preceding article by D. McClure.

Key to Tables. *Salaries* are listed in hundreds of dollars. Nine-month salaries are based on 9-10 months teaching and/or research, not adding extra stipends for summer grants or summer teaching or the equivalent. *Years* listed refer to the academic year in which the doctorate was received. *M* and *F* are Male and Female respectively. *One year experience* means that the persons had experience limited to one year or less in the same position or a position similar to the one reported; some persons receiving a doctorate had been employed in their present position for several years. $(X + Y)$ means there are *X men and Y women* in the 1990 sample. Quartile figures are given only in cases where the number of responses is large enough to make them meaningful.

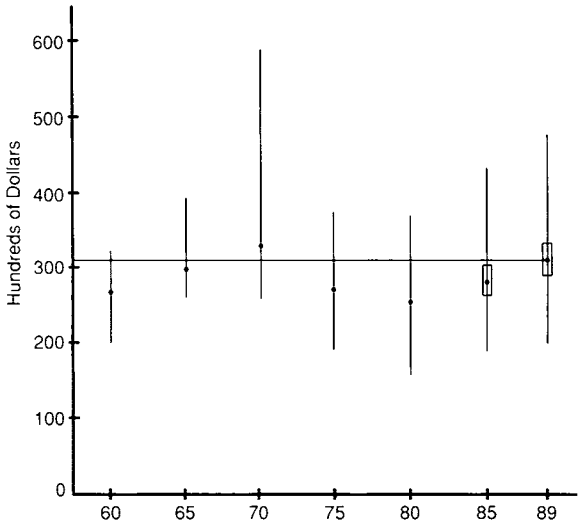
Graphs. The horizontal line represents the median salary for 1989 in hundreds of dollars. The points plotted are the median salaries for each year converted to 1989 dollars using the implicit price deflator prepared annually by the Bureau of Economic Analysis, U.S. Department of Commerce. (Because the deflator is not yet available for this year, the 1990 figures do not appear on the graphs). The boxes show the middle half of the population, where the quartile data are available.

Note that salaries for teaching, or teaching and research, have yet to return to their high point of 1970, although steady progress has been made since 1980. (For further details, see Donald Rung's article, "A Fifteen Year Retrospective on Academic Salaries of U.S. Doctorate Holding Faculty," in the November 1985 issue of *Notices*, pages 772-773.)

Nine-Month Salaries

Ph.D. Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1989 $
TEACHING OR TEACHING AND RESEARCH (187 + 50)						
1960	49		65		80	266
1965	70		80		105	299
1970	85		110		195	331
1975	90	120	128	135	173	273
1980	105	155	171	185	250	252
1985	170	230	250	270	380	283
1986	170	250	269	290	400	298
1987	165	260	280	300	517	301
1988	200	275	293	314	575	305
1989	200	290	310	330	478	310
1990	230	305	320	350	710	
1987M	165	260	280	300	517	
1987F	230	251	280	325	420	
1988M	200	274	290	315	520	
1988F	216	275	299	314	575	
1989M	200	290	305	330	478	
1989F	220	295	310	330	470	
1990M	230	306	320	350	710	
1990F	250	300	325	360	493	
One year experience (169 + 39)						
1990M	230	309	320	350	710	
1990F	250	305	325	360	470	

Nine-Month Teaching



Nine-Month Salaries

Ph.D. Year	Min	Median	Max	Reported Median in 1989 $
		RESEARCH (7 + 0)		
1960	52	65	80	266
1965	71	81	90	303
1970	78	105	160	316
1975	100	—	110	—
1980	125	137	180	202
1985	205	235	250	268
1986	215	245	280	272
1987	250	300	300	322
1988	260	280	385	292
1989	235	270	330	270
1990	230	300	404	
1987M	250	300	300	
1987F	—	—	—	
1988M	260	280	385	
1988F				
1989M	235	270	330	
1989F			—	
1990M	230	300	404	
1990F	—	—	—	
One year experience (7 + 0)				
1990M	230	300	404	
1990F				

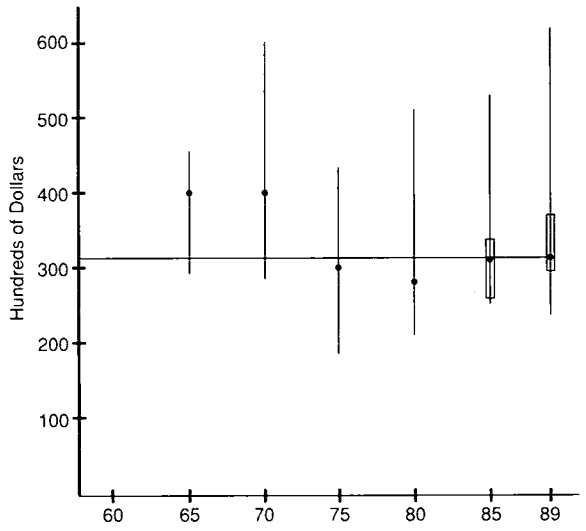
Nine-Month Research

Graph omitted because sample size too small.

Twelve-Month Salaries

Ph.D. Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1989 $
			TEACHING OR TEACHING AND RESEARCH (29 + 6)			
1960	.....		No data		.....	
1965	78		104		121	389
1970	95		128		200	385
1975	87		145		204	309
1980	143		195		350	287
1985	220	230	273	300	470	311
1986	220	265	320	360	480	355
1987	200	283	315	357	520	338
1988	220	313	330	360	480	344
1989	238	290	315	370	620	315
1990	225	318	365	404	670	—
1987M	200	270	300	358	520	
1987F	300	320	339	357	450	
1988M	220	308	330	355	480	
1988F	329	335	350	365	441	
1989M	238	295	315	370	620	
1989F	275	290	314	380	435	
1990M	225	316	360	400	670	
1990F	250	320	383	420	425	
One year experience (24 + 5)						
1990M	225	305	338	404	670	
1990F	250	365	400	420	425	

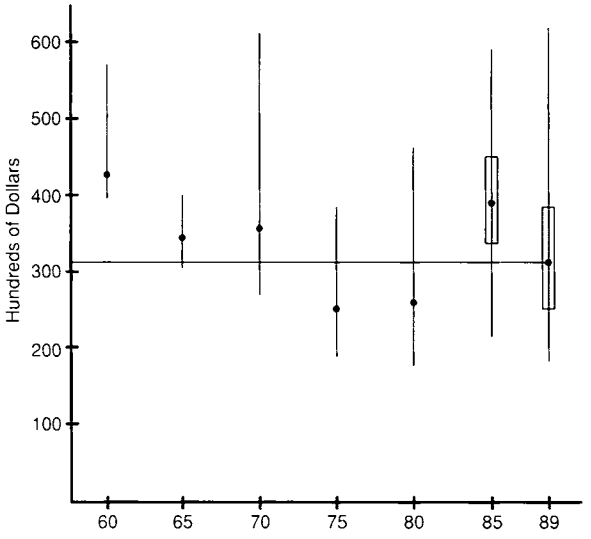
Twelve-Month Teaching



Twelve-Month Salaries

Ph.D. Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1989 $
			RESEARCH (25 + 2)			
1960	97		105		140	429
1965	81		93		107	348
1970	90		120		205	361
1975	90		119		180	254
1980	120		180		321	265
1985	190	295	342	400	520	390
1986	160	240	300	325	510	333
1987	200	260	287	337	430	308
1988	200	245	295	331	505	307
1989	180	250	317	385	623	317
1990	180	280	300	365	546	
1987M	200	250	282	337	400	
1987F	300	308	316	373	430	
1988M	200	240	280	330	505	
1988F	280	320	330	350	360	
1989M	180	250	300	393	623	
1989F	200	295	350	373	400	
1990M	180	280	300	360	546	
1990F	330	330	365	400	400	
One year experience (22 + 2)						
1990M	180	280	300	360	546	
1990F	330	330	365	400	400	

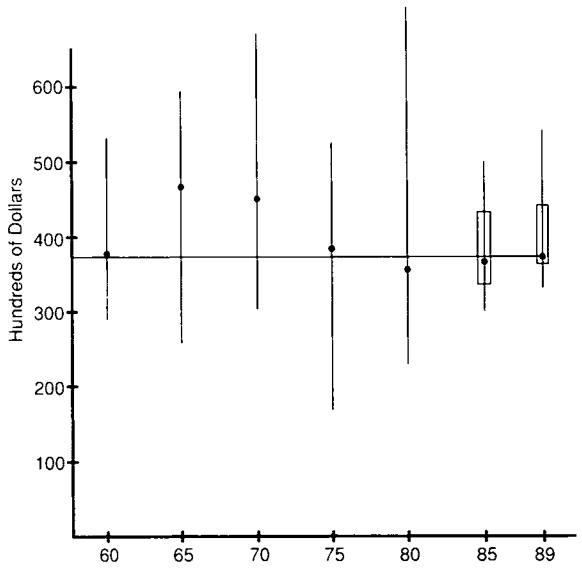
Twelve-Month Research



Twelve-Month Salaries

Ph.D. Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1989 $
			GOVERNMENT (10 + 3)			
1960	72		93		130	380
1965	70		126		160	471
1970	100		150		223	451
1975	78		182		247	388
1980	156		244		501	360
1985	263	294	325	381	440	370
1986	270	330	400	449	610	444
1987	200	290	360	465	500	386
1988	240	298	343	405	436	357
1989	330	363	378	438	540	378
1990	320	345	378	430	587	
1987M	200	290	360	465	500	
1987F						
1988M	240	290	332	360	436	
1988F	380	380	405	430	430	
1989M	330	363	378	438	540	
1989F						
1990M	320	345	375	430	587	
1990F	330	354	378	429	480	
One year experience (8 + 3)						
1990M	320	338	350	429	587	
1990F	330	354	378	429	480	

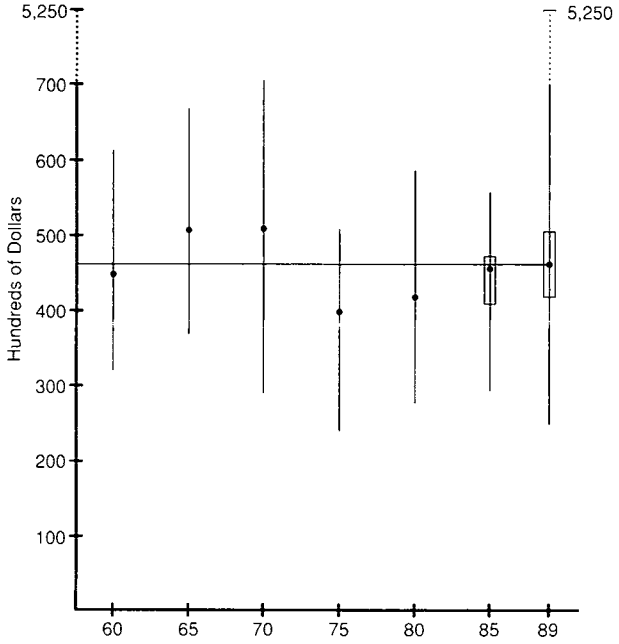
Twelve-Month Government



Twelve-Month Salaries

Ph.D. Year	Min	Q_1	Median	Q_3	Max	Reported Median in 1989 $
			BUSINESS AND INDUSTRY (39 + 9)			
1960	78		110		150	450
1965	100		136		180	508
1970	96		170		235	511
1975	114		187		240	398
1980	190		284		400	419
1985	260	360	400	420	493	456
1986	324	373	425	477	750	471
1987	290	400	451	500	1500	484
1988	300	400	440	490	1100	458
1989	250	420	464	505	5250	464
1990	320	438	495	533	700	
1987M	290	400	465	517	1500	
1987F	300	394	424	466	502	
1988M	300	400	431	490	1100	
1988F	375	437	454	495	660	
1989M	250	420	464	513	5250	
1989F	375	430	470	500	516	
1990M	320	443	490	533	630	
1990F	390	440	500	525	700	
One year experience (24 + 4)						
1990M	320	430	470	513	622	
1990F	420	430	465	495	500	

Twelve-Month Industry



1990 CBMS Survey

Questionnaires for the 1990 Survey of Undergraduate Programs in the Mathematical Sciences and Computer Science, conducted by the Conference Board of the Mathematical Sciences and funded by NSF, were mailed in fall to selected departments. Donald C. Rung, director of the 1990 CBMS Survey, expects to have preliminary results in spring 1991. Survey reports will be published as quickly as possible, and copies will be available from the Mathematical Association of America.

In addition to the usual detailed enrollment and faculty profile data, the 1990 CBMS Survey contains questions on both the undergraduate major in the mathematical sciences and mathematical sciences libraries.

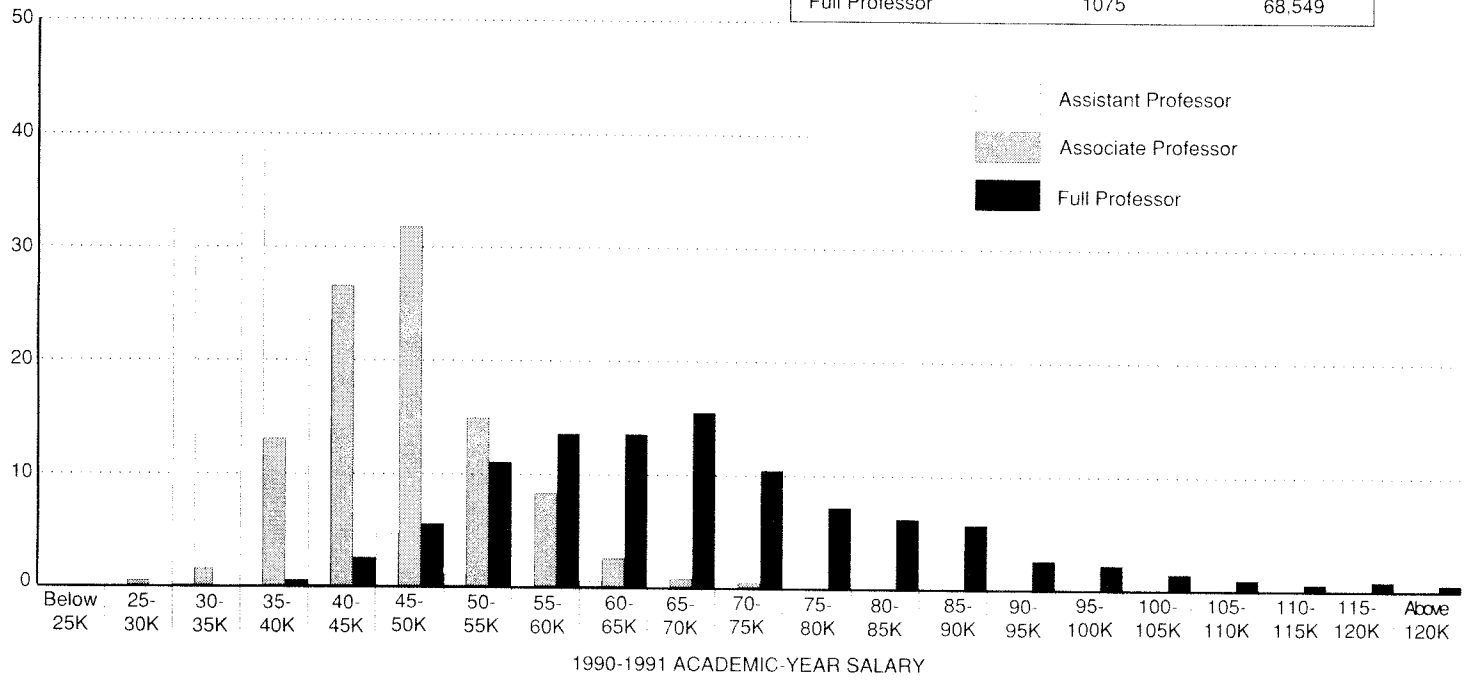
Although the deadline for survey returns was November 1, 1990, late returns will be accepted. Departments in the sample who have not yet responded are urged to complete and return their questionnaires as soon as possible to: CBMS Survey, Attn: Monica Foulkes, AMS, P.O. Box 6248, Providence, RI 02940-6248.

Faculty Salary Survey 1990-1991

The charts on the following pages display faculty salary data for Groups I-VI, M and B: faculty salaries by rank, mean salaries by rank, the number of faculty within that rank, and the number of usable returns for the group. Departments were asked to report the number of faculty whose 1990-91 academic-year salaries fell within given salary intervals.

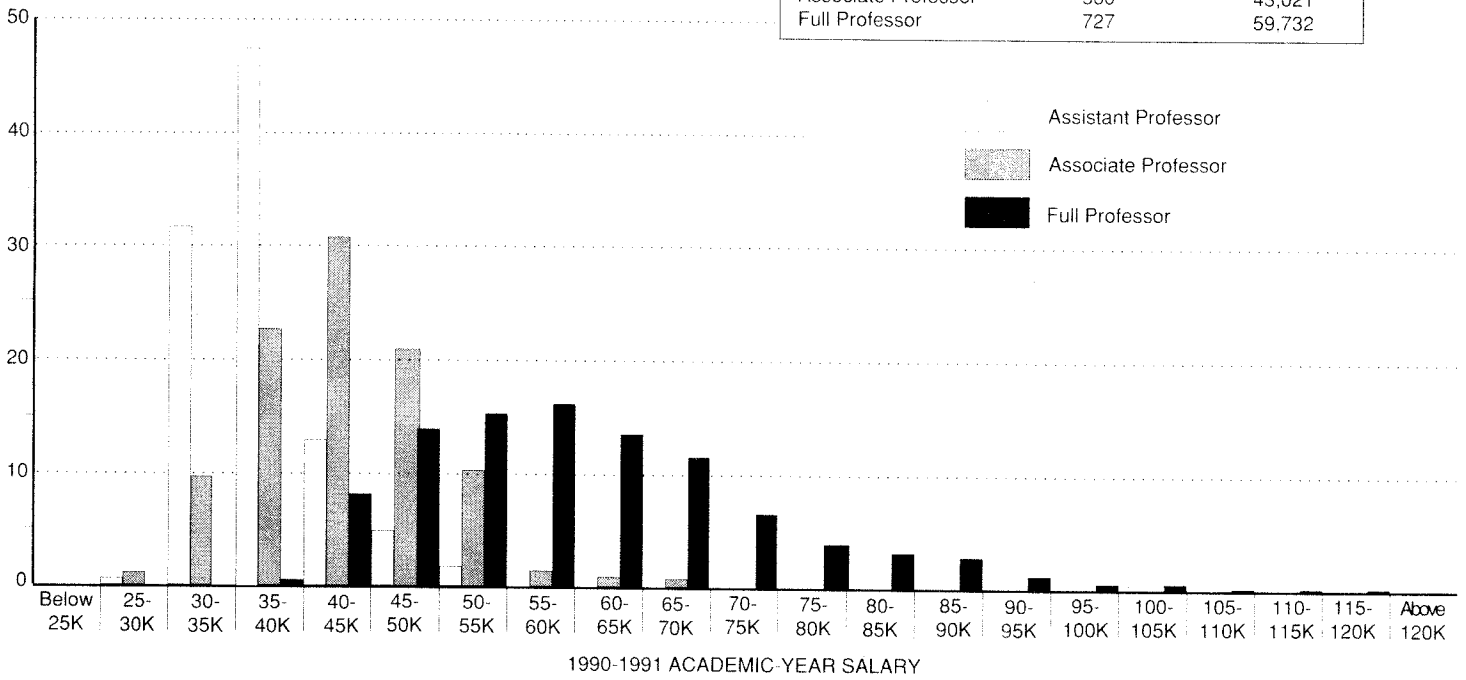
FACULTY SALARIES 1990-91
GROUP I - Doctorate granting departments
33 of 39 reporting (85%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	186	$37,883
Associate Professor	267	47,354
Full Professor	1075	68,549



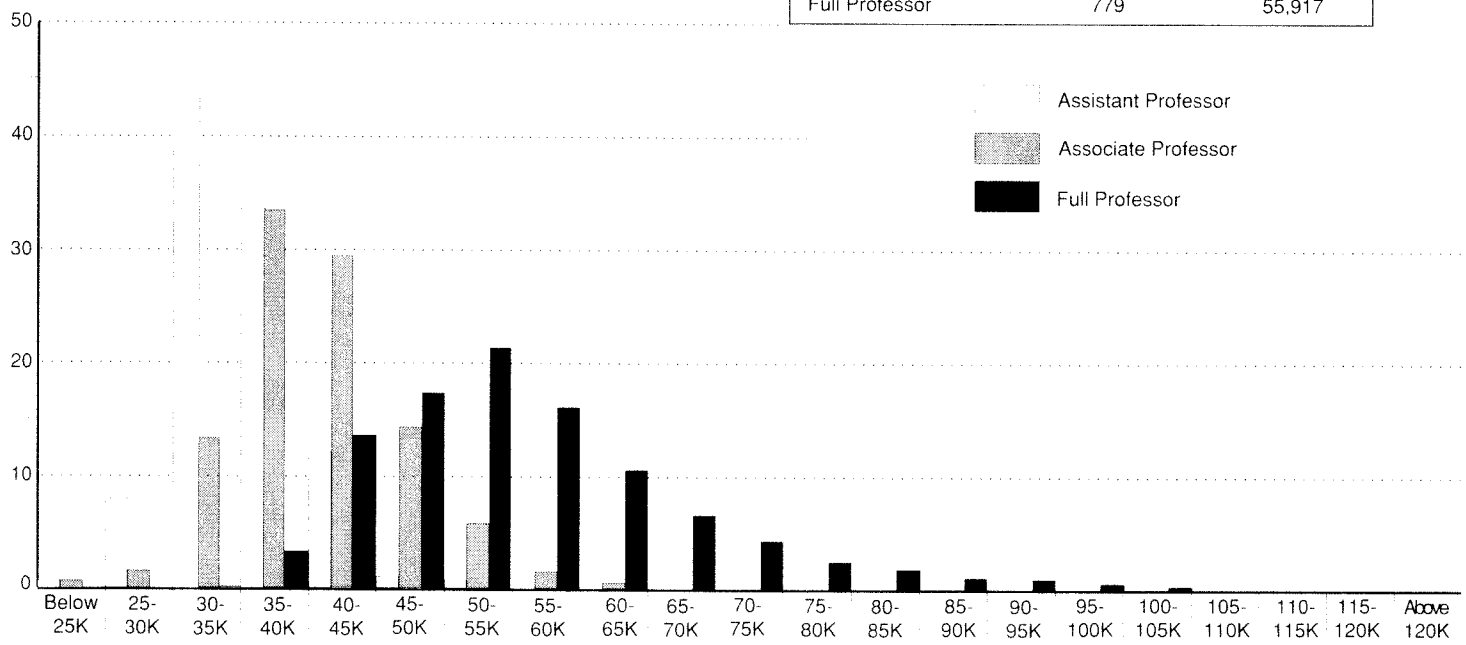
FACULTY SALARIES 1990-91
GROUP II - Doctorate granting departments
38 of 43 reporting (88%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	235	$39,827
Associate Professor	360	43,021
Full Professor	727	59,732



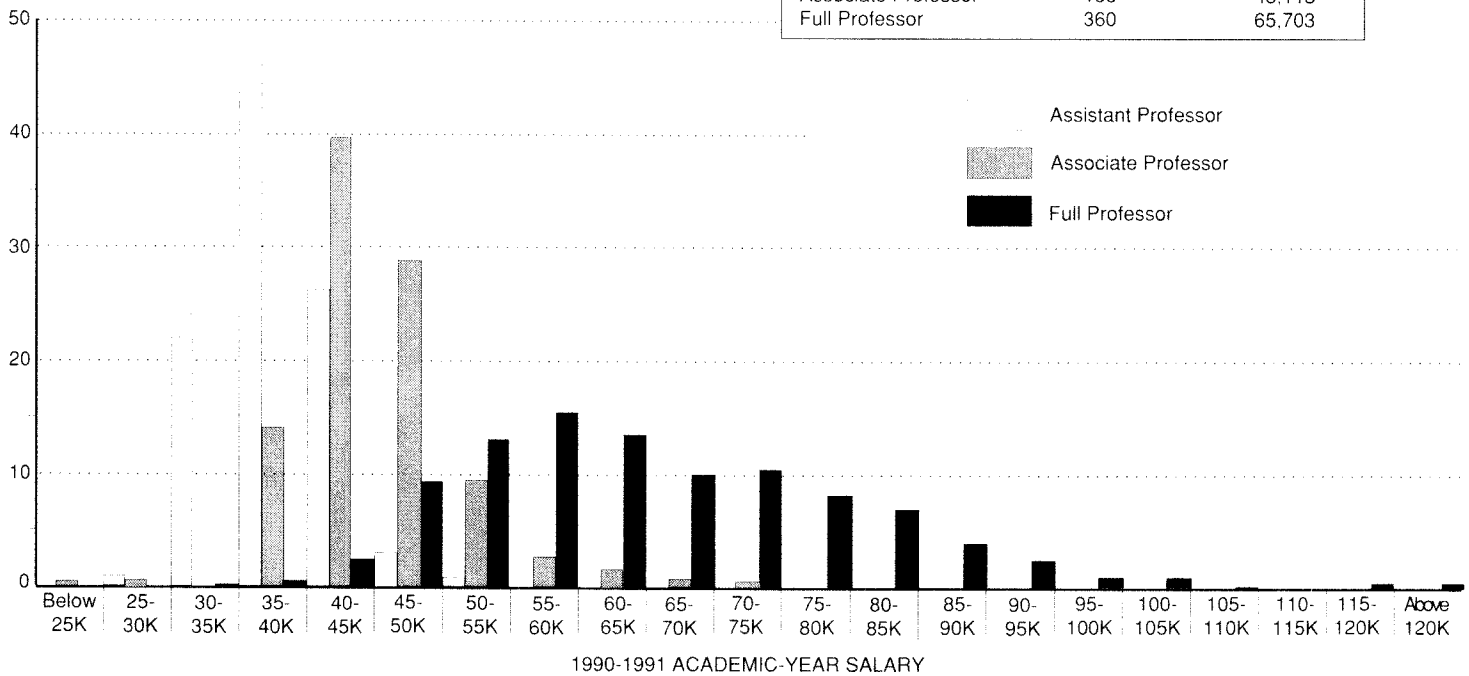
FACULTY SALARIES 1990-91
GROUP III - Doctorate granting departments
72 of 86 reporting (84%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	460	$34,977
Associate Professor	522	40,737
Full Professor	779	55,917



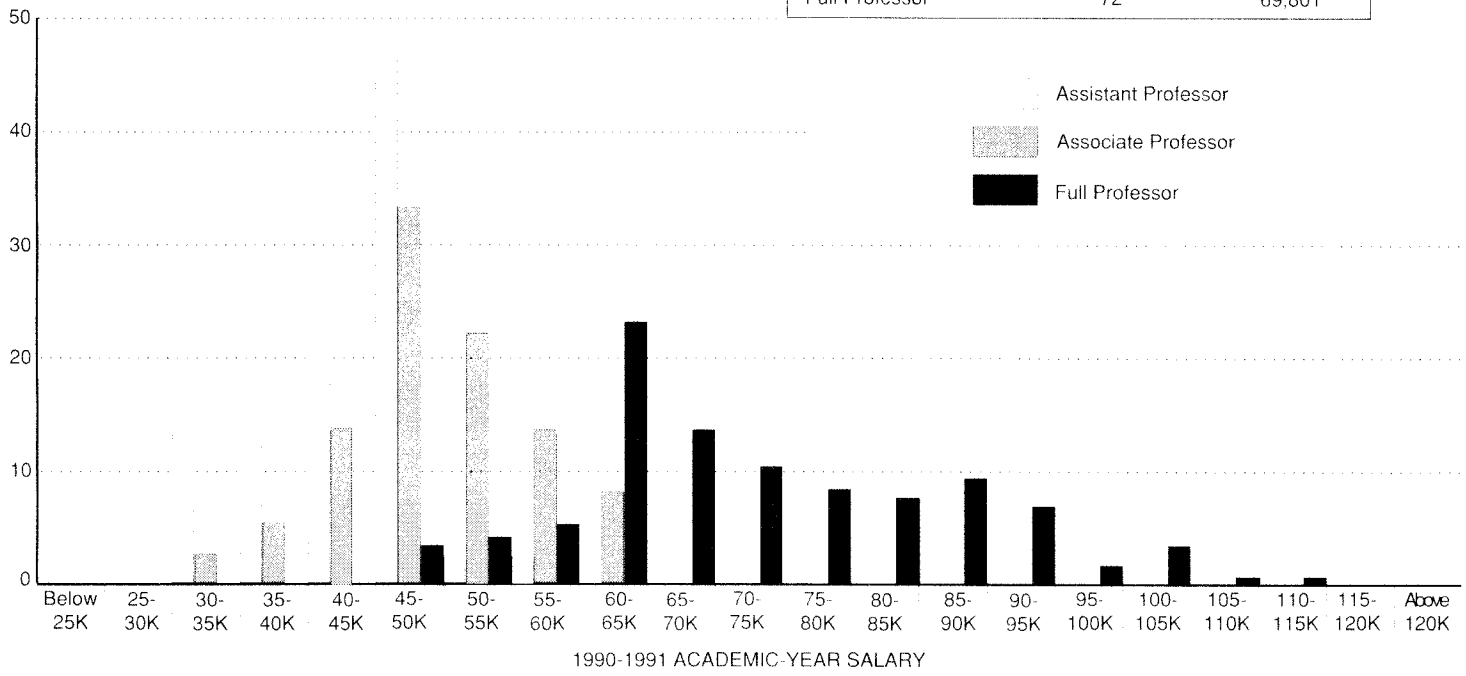
FACULTY SALARIES 1990-91
GROUP IV - Doctorate granting departments
50 of 74 reporting (68%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	162	$35,883
Associate Professor	158	45,118
Full Professor	360	65,703



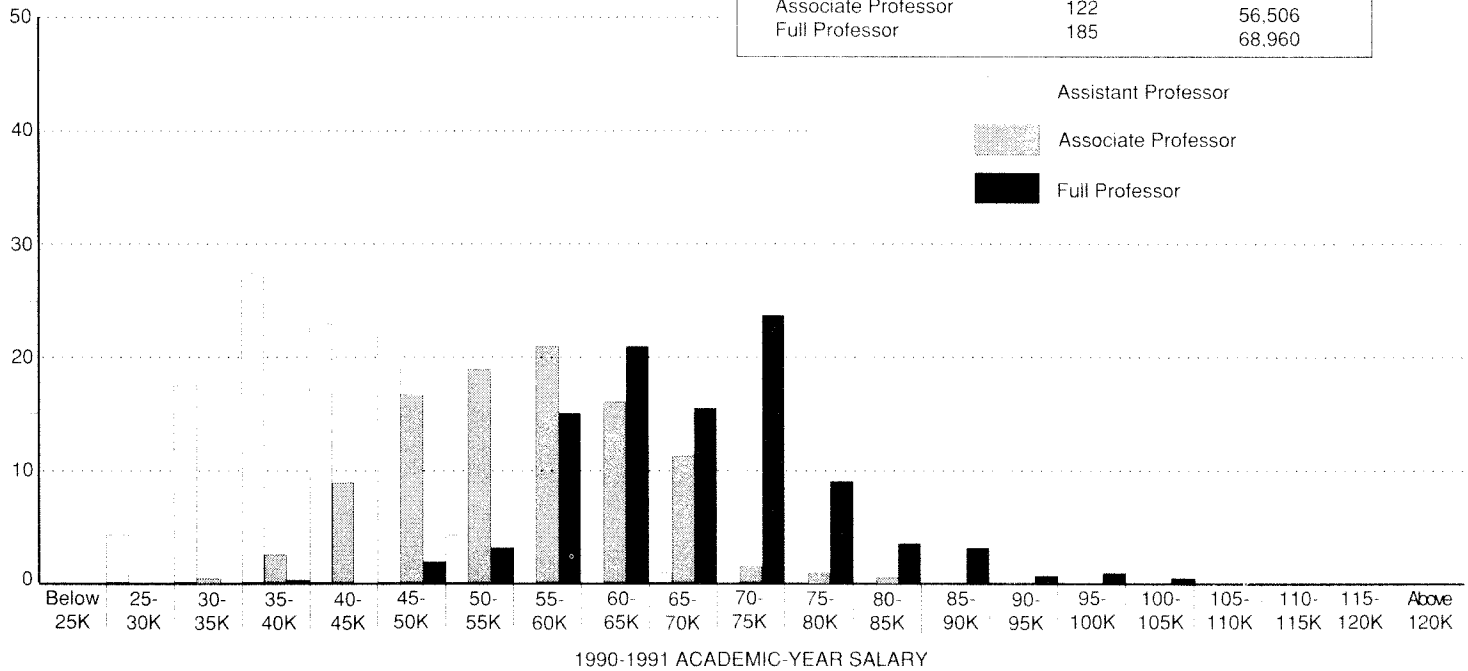
FACULTY SALARIES 1990-91
GROUP V - Doctorate granting departments
14 of 49 reporting (29%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	32	$44,162
Associate Professor	28	49,156
Full Professor	72	69,801



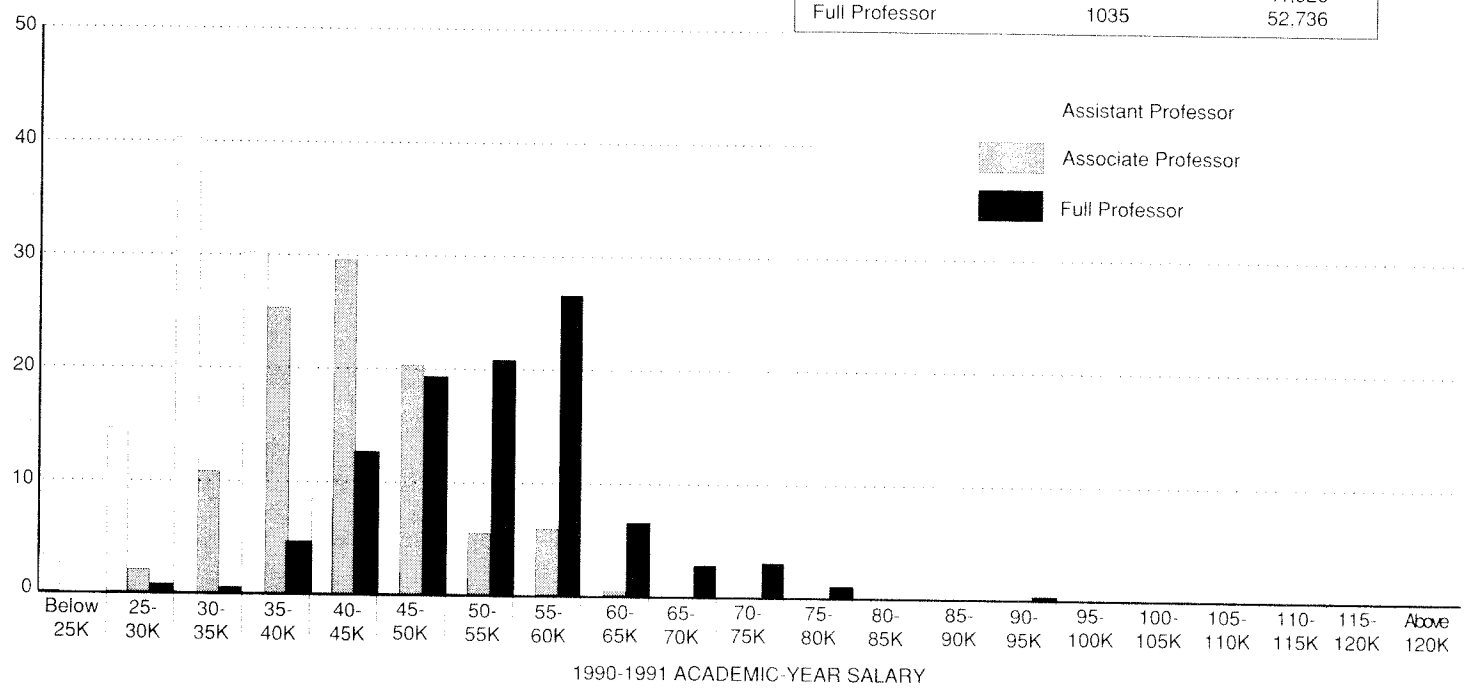
FACULTY SALARIES 1990-91
GROUP VI - Canadian doctorate granting departments
(Salaries reported in Canadian $)
15 of 30 reporting (50%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	77	$39,475
Associate Professor	122	56,506
Full Professor	185	68,960



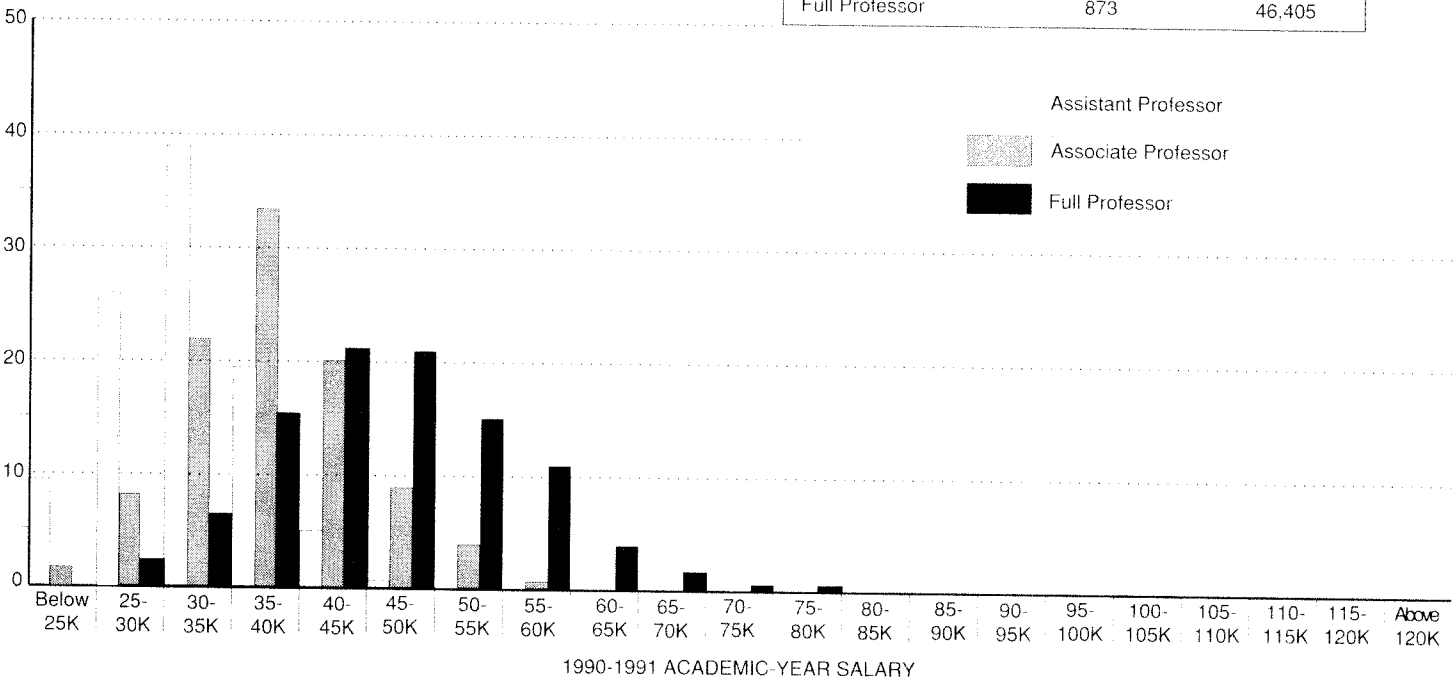
FACULTY SALARIES 1990-91
GROUP M - Master's degree granting departments
163 of 263 reporting (62%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	873	$34,517
Associate Professor	968	41,920
Full Professor	1035	52,736



FACULTY SALARIES 1990-91
GROUP B - Bachelor's degree granting departments
456 of 975 reporting (47%)

RANK	NUMBER REPORTED	MEAN SALARY
Assistant Professor	1012	$31,579
Associate Professor	932	38,066
Full Professor	873	46,405



Doctoral Degrees Conferred 1989–1990

The annual list of doctoral degrees in the mathematical sciences and related subjects reports 991 degrees conferred between July 1, 1989, and June 30, 1990 by 224 departments in 153 universities in the United States and Canada. Each entry contains the name of the recipient and the thesis title. The number in parentheses following the name of the university is the number of degrees listed for that university.

ALABAMA

Auburn University (3)

ALGEBRA, COMBINATORICS AND ANALYSIS

Calahan, Rebecca, *Automorphisms of Steiner triple systems.*

FOUNDATIONS, ANALYSIS AND TOPOLOGY

Smiley, Mark D., *Metric dimensions of fractals.*

Yang, Zhan-Bo, *On homogeneity problems.*

University of Alabama, Huntsville (1)

MATHEMATICS

Grinstead, Dana Leigh, *Algorithmic templates and multiset problems in graphs.*

University of Alabama, Tuscaloosa (7)

MANAGEMENT SCIENCE AND STATISTICS

Bowen, Larry J., *Comparing estimators of exponential reliability using Pitman's measure of closeness.*

Cobb, Richard, *Development of design guidelines for carrier sense multiple-access with collision detection (CSMA/CO) local area network.*

deSa, Derek J. M. M., *Vulnerability of flow networks.*

Kim, Young Hwan, *A forecasting methodology for maintenance cost of long-life equipment.*

Margavio, Thomas, *Multivariate moving average control charts for the process mean.*

Munshi, Arpana, *Mis-classification in logistic regression.*

Pittman, Terry Obert, *X bar charts with bone tests.*

ARIZONA

Arizona State University (6)

MATHEMATICS

Al-Musallam, Fadell Abdulazeez, *An upper estimate for the distance to the essentially G_1 operators.*

Duncan, Della, *Symmetries in flat space times.*

Elkhader, Abder-Rahman, *Systems of ordinary differential equations with some monotonicity.*

Kim, Young Ik, *Bifurcation of a generalized logistic delay iterative map having one real control parameter.*

Rosenthal, Joachim, *Geometric methods for feedback stabilization of multivariable linear systems.*

Wang, Xiaochang, *Additive inverse eigenvalue problems and pole placement of linear systems.*

University of Arizona (7)

MATHEMATICS

Alawneh, Zakaria, *A numerical method for solving certain nonlinear integral equations arising in age-structured populations dynamics.*

Barrera-Mora, Fernando, *On radical extensions and radical powers.*

Fahlberg-Stojanovska, Linda, *Stochastic stability of Lozi-mappings.*

Freeman, Jonathan Dennis, *Estimation of astronomical images from the bispectrum of atmospherically distorted infrared data.*

Halpren, David, *The squeezing of red blood cells through tubes and channels of near critical dimensions.*

Powell, James, *Nonlinear fronts in a quintic amplitude equation.*

Valdez-Torres, Jose, *Multivariate discrete failure rates with some applications.*

ARKANSAS

University of Arkansas (1)

MATHEMATICAL SCIENCES

Jang, Wuufang, *Automata, transformation semigroups, and languages: Standard automata for varieties of formal languages.*

CALIFORNIA

California Institute of Technology (9)

APPLIED MATHEMATICS

Hayes, Catherine Kent, *Diffusion and stress driven flow in polymers.*

Kovacic, Gregor, *Chaos in a model of the forced and damped Sine-Gordon equation.*

McLachlan, Robert I., *Separated viscous flows via multigrid.*

Morlet, Anne Chantal Marie, *I. Numerical experiments for the computation of invariant curves in dynamical systems. II. Numerical convergence results for a one-dimensional Stefan problem.*

Shinn-Mendoza, Rachel Elizabeth, *Shocks and instabilities in traffic.*

MATHEMATICS

Ashlock, Daniel Abram, *A Theory of permutation polynomials using compositional attractors.*

Kafkoulis, George, *Homogeneous sequences of cardinals for ordinal definable partition relations.*

Magaard, Kay, *The maximal subgroups of the Chevalley groups $F_4(F)$ where F is a finite or algebraically closed field of characteristic $\neq 2, 3$.*

Uzcategui, Carlos, *Smooth sets for Borel equivalence relations and the covering property for σ-deals of compact sets.*

Claremont Graduate School (2)

MATHEMATICS

Fang, Weifu, *Identification of transistor contact resistivity.*

Huang, Wenzhang, *Stability and bifurcation for a multiple group model for dynamics of HIV/AIDS transmission.*

Stanford University (14)

ENGINEERING-ECONOMIC SYSTEMS

Bosch, Deborah Karen, *Decision analysis using hierarchical value functions.*

Cronshaw, Mark Bernard, *Strategic behavior in dynamic settings.*

Davis, Donald Boyce, *The effect of ambiguity of lottery preferences.*

Garcia-Bullé, Mauricio, *Multi-agent network equilibrium with applications to transportation systems.*

Pichler, Pegaret Schuerger, *Optimal pricing policies of a monopolistic market maker.*

Smith, James E., *Moment methods for decision analysis.*

MATHEMATICS

Dai, Jiangang, *Steady-state analysis of reflected Brownian motions: Characterization, numerical methods and queueing applications.*

Hunt, Brian Ramen, *Analysis of turbulent and ergodic problems.*

Jorgenson, Jay, *Canonical and Arakelov metrics, and Faltings delta function.*

Khuri, Hala Halim, *Determinants of Laplacians on the moduli space of Riemannian surface.*

Lundelius, Rolf Eric, *Asymptotics of the determinant of the Laplacian on hyperbolic surfaces of finite volume.*

Morris, Macdonald Scott, *Mathematical methods for molecular sequence analysis and genome map assembly.*

Ross, Martin, *Stability properties of complete 2 dimensional minimal surfaces in euclidean space.*

Tillman, Ulrike, *K-theory of topological group algebras.*

University of California, Berkeley (34)

BIOSTATISTICS

Lock, Michael Daniel, *Optimizing density estimates based on unweighted and weighted mean integrated square error.*

INDUSTRIAL ENGINEERING AND OPERATIONS RESEARCH

Ando, Toshiya, *An extension of Levengerg-Marquardt method for unconstrained optimization.*

Datta, Koushik, *Predicting risk reduction of aircraft collision avoidance systems.*

Irony, Telba Zalkind, *Modeling, information extraction and decision making: A Bayesian approach to some engineering problems.*

Kim, Jong Soo, *Short-term production planning of multi-stage processing lines.*

Lin, Woo-Tsong, *An object-oriented system for knowledge-based production scheduling.*

Min, Kyung Jo, *Pricing delivery priority and spec. level of custom semiconductor chips.*

Taleb-Ibrahimi, Mounira, *Modeling and analysis of container storage in ports.*

Yang, Hee Joong, *The influence of human errors on nuclear incidents.*

MATHEMATICS

Carbonera, Carlos Daniel, *Linearizations of ordinary differential equations.*

Carroll, Catherine Andree, *On the closing lemma for flows on the torus.*

Eggleston, Trent Alan, *A functional calculus and its applications to inner functions.*

Geller, William, *Orbit types and topological entropy.*

Ginzburg, Viktor, *On closed characteristics of 2-forms.*

Gross, Mark William, *Surfaces in the four-dimensional Grassmannian.*

Hirsch, Michael David, *Applications of topology to lower bound estimates in computer science.*

Kleiner, Bruce Alan, *Riemannian four-manifolds with nonnegative curvature and continuous symmetry.*

Laca, Marcelo Enrique, *Representations of Cuntz algebras and endomorphisms of type I factors.*

Lazarus, Andrew Joseph, *The class number and cyclotomy of simplest quartic fields.*

Lim, Chong Hai, *Endomorphism rings of Jacobian varieties of Fermat curves.*

Ling, San, *On the arithmetic of modular curves.*

Lopes-Filho, Milton da Costa, *Microlocal regularity and symbols for distributions.*

Lu, Jiang-Hua, *Multiplicative and affine Poisson structures on Lie groups.*

Oldham, Janis Marie, *Connections in super principal fiber bundles.*

Quaife, Arthur William, *Automated development of fundamental mathematical theories.*

Sanker, David Vincent, *A characterization of irrationality.*

Shearer, James William, *Global existence and compactness in L^p for systems of conservation laws.*

Smith, Gene Ward, *Generic cyclic polynomials and some applications.*

Sommer, Richard D., *Transfinite induction and hierarchies generated by transfinite recursion within Peano arithmetic.*

Tanbay, Betül, *Extensions of pure states on algebras of operators.*

Tang, Tai-Man, *On C^*-algebras related to Schrödinger type operations.*

Xu, Ping, *Morita equivalence of Poisson manifolds.*

Xuan, Xiaohua, *Nonlinear boundary value problems: Computation, convergence, and complexity.*

Zheng, Yuxi, *Concentration-cancellation phenomena for weak solutions to certain nonlinear partial differential equations.*

University of California, Davis (7)

MATHEMATICS

Baber, Farhat-Un Nisa Farhat, *Power groupoids of groupoids of order ≤ 3.*

Borges, Carlos Freitas, *Numerical methods for illumination models in realistic image synthesis.*

Dad-Del, Ali Akbar, *Covering cyclic groups by sections.*

Frezza, Ruggero, *Models of higher-order and mixed-order Gaussian reciprocal processes with application to the smoothing problem.*

Howard, Eric Jordan, *A multidimensional Perron integral and the divergence theorem.*

Wehrly, Albert C., *Uniform spaces.*

Yamaoka, Kenya, *The global determination of the glass of finite regular semigroups.*

University of California, Irvine (2)

MATHEMATICS

Melles, Garvin Norman, *Classification theory and generalized recursive functions.*

Thau, Kuo-Tong, *A numerical solution of Abel's integral equation in terms of Fresnel integrals.*

University of California, Los Angeles (8)

BIOSTATISTICS

Go, Oscar Tin, *Efficient estimation in a generalized regression model.*

Watson, George A., *Influential observations in survival models with censored data: An approach based on the influence function.*

MATHEMATICS

Cunningham, Daniel Wendell, *The real core model.*

Liu, Jian-Guo, *Homogenization and numerical methods for hyperbolic equations.*

Schusteff, Aaron, *Product formulas for relative Nielson numbers of fiber map pairs.*

Váradi, Ferenc, *Hamiltonian perturbation theory applied to planetary motions.*

Yamanouchi, Takehiko, *Duality for actions and coactions of measured groupoids on von Neumann algebras.*

Zhou, Qing, *Three-dimensional geometric cone structures.*

University of California, Riverside (1)

MATHEMATICS AND COMPUTER SCIENCE

Mehlman, Marc Harvey, *Moving average representation and prediction for multidimensional strongly harmonizable processes.*

University of California, San Diego (11)

MATHEMATICS

Altschuler, Steven Jeffrey, *Singularities of the curve shrinking flow for space curves.*

Au, Thomas Kwok-Keung, *Approximating epsilon-homotopy equivalences by homeomorphisms on 3-manifolds.*

Bergeron, Nantel, *On the hyperoctahedral group.*

Compton, Robert Christopher, *Hamilton cycles in the Cayley graph of* SN *and a doubly adjacent Gray code.*

Dong, Rui-Tao, *Nodal sets of eigenfunctions on Riemann surfaces.*

Hong, Ho Siao, *Generic determinantal identities and expansion theorems by diagonal elements.*

Marson, Mark Evan, *Holomorphic extension for solutions of locally integrable systems of complex vector fields.*

Slack, Michael David, *A classification theorem for homotopy commutative H-spaces with finitely generated* mod 2 *cohomology rings.*

Twainy, Fadi, *The time decay of solutions to the scalar wave equation in Schwarzschild background.*

Welfert, Bruno Denis, *A posteriori error estimates and adaptive solution of fluid flow problems.*

Wu, Lang-Fang, *The Ricci flow on 2-dimensional orbifolds with positive curvature.*

University of California, Santa Barbara (7)

MATHEMATICS

Chang, Shu-Chu, *Two-sided equivalence with respect to subgroups of the modular group.*

Eudave-Muñoz, Mario, *Band sums of knots and composite links. The cabling conjecture for strongly invertible knots.*

Moulin, Hervé Claude, *Problems in the inverse dynamics solution for flexible manipulators.*

STATISTICS AND APPLIED PROBABILITY

Boneh, Shahar, *Optimal stopping rules for sums of non-negative independent random variable.*

Butler, Steven, *The final size distribution and approximations for contact epidemic models, and for some epidemic models in random environments.*

Kafai, Mohammad, *Some nonparametric tests based on "near-matches".*

Sengupta, Debasis, *Statistical inference on discrete life-history data and some reliability problems.*

University of California, Santa Cruz (1)

MATHEMATICS

Valdes, Linda, *Cycles and spanning trees in cubic graphs.*

COLORADO

Colorado School of Mines (2)

MATHEMATICS

Anderson, Paul L., *Asymptotic results and identification for cyclostationary time series.*

Kovari, Louis D., *Global constrained null controllability of nonlinear neutral systems.*

Colorado State University (3)

STATISTICS

Haas, Timothy Cadwell, *Cognitive modeling with Bayesian belief networks.*

Ouyang, Zhao, *Investigation on some estimators and strategies in sampling, proposed by Srivastava.*

Taylor, Charles H., *Optimal measurement designs when errors are correlated.*

University of Colorado, Boulder (6)

MATHEMATICS

Bardwell, Robert A., *Asymptotic behavior of certain estimators under mild regularity conditions.*

Cole, Rodney Elias, *L_p spectral analysis with an L_∞ upper bound.*

Darby, Carl, *Countable Ramsey games and partition relations.*

Khalfan, Humaid F., *Topics in quasi-Newton methods for unconstrained optimization.*

Marshall, Kristen H., *The asymptotic distribution of the likelihood ratio statistic under nonstandard conditions.*

Thunder, Jeffrey Lin, *An asymptotic estimate for heights of algebraic subspaces.*

University of Colorado, Denver (2)

MATHEMATICS

Liu, Chaoqun, *Multilevel adaptive methods in computational fluid dynamics.*

Cai, Zhiqiang, *Theoretical foundations for the finite volume element method.*

University of Northern Colorado (3)

MATHEMATICS AND APPLIED STATISTICS

Amin, Rashad M., *Estimation of the power function for the Cochran Q test and determination of confidence intervals.*

Obrzut, Ann, *Early identification of school dropouts using modified interaction detection and two-group discriminant analysis.*

Pelkey, William L., *An investigation into the spatial randomness of crime series.*

CONNECTICUT

University of Connecticut (9)

MATHEMATICS

Hwang, Sunwook, *Aspects of commutative Banach algebras.*

Jen, Kuo-Ching, *Numerical investigation of periodic solutions for a suspension bridge model.*

Ko, Seok-Ku, *Embedding Riemann surfaces in Riemannian manifold.*

Shaker, Aihua, *Maximum principle methods for semilinear elliptic problems.*

Xu, Xingwang, *On Möbius groups of Riemannian manifolds.*

Yom, Peter Dongjun, *A characterization of a class of torsion-free Abelian groups.*

STATISTICS

Chung, Younshik, *On estimation of parameters from compound power series distributions.*

Liu, Pei-San Liao, *On estimation of parameters and reliability from generalized life models.*

Solanky, Tumulesh K. S., *Some parametric and nonparametric accelerated sequential procedures for selecting the best treatment.*

Wesleyan University (1)

MATHEMATICS

Garcia Ferreira, Salvador, *Various orderings on the space of ultrafilters.*

Yale University (13)

MATHEMATICS

Costanzo-Alvarez, Sabatino, *A new link isotopy invariant.*

Fang, Xiang, *The Cauchy integral of Calderon and analytic capacity.*

Hsieh, Chun-Chung, *Direct and inverse scattering theory for the operator* $\frac{\partial}{\partial t} - \frac{\partial^2}{\partial x^2} - \frac{\partial^2}{\partial y^2}$.

Kang, Seok-Jin, *Gradations and structure of Kac-Moody Lie algebras.*

Kim, Minhyong, *Lower bounds for lattice vectors and arithmetic intersection theory.*

Liu, Li-shi, *Kostant's formula for Kac-Moody Lie algebras.*

Nakano, Daniel Ken, *Projective modules over Lie algebras of Cartan type.*

Rudnick, Zeev, *Poincare series.*

Wu, Der-Chyi, *A* 2×2 *scattering problem and its associated nonlinear evolution equation.*

Wu, Sijue, *Nonlinear singular integrals and analytic dependence.*

Zhu, Chen-bo, *Two topics in harmonic analysis on reductive groups.*

Zhu, Yongchang, *Vertex operator algebras, modular forms and elliptic functions.*

OPERATIONS RESEARCH/MANAGEMENT SCIENCE

Caldis, Grant Henry, *Convertible bonds: Pricing, tests of market efficiency, and the intertemporal relation between market and model prices.*

DELAWARE

University of Delaware (2)

MATHEMATICAL SCIENCES

Kedzierawski, Andrzej Wladyslaw, *Inverse scattering problems for acoustic waves in an inhomogeneous medium.*

Xu, Yongzhi, *Direct and inverse scattering of acoustic waves in shallow oceans.*

DISTRICT OF COLUMBIA

American University (4)

MATHEMATICS AND STATISTICS

Boria, Vittorio, *Marin Mersenne: Educator of scientists.*

Modarres-Hakimi, Mohammad Reza, *Further aspects of the tests of the equality of correlation matrices.*

Mokatrin, Ahmad, *The interval hypothesis with applications to the problem of bioequivalence.*

Sheehan, Kate, *The relationship of gender bias and standardized tests to the mathematics competency of university men and women.*

Catholic University of America (1)

MATHEMATICS

Susilo, Frans, *A theory of Dirac integral spaces and the isomorphism between the category of these spaces and the category of Lebesgue measure spaces.*

George Washington University (5)

MATHEMATICS

Sedaghat, Hassan, *New constructions in semigroup compactification theory.*

OPERATIONS RESEARCH

Lindsay, Kenneth S., *On accelerating an iterative method to calculate the steady-state distribution for finite aperiodic irreducible Markov chains.*

Samuelson, Douglas Alan, *Controlling queuing systems used for acquisition.*

STATISTICS/COMPUTER AND INFORMATION SYSTEMS

Lindblad, Anne, *A nonparametric estimate of the optimum of a response curve.*

Verme, Dante Americo, *Effects of outliers on the cross-correlation function in transfer function models.*

FLORIDA

Florida State University (5)

MATHEMATICS

Diao, Yuanan, *On the knotting of randomly embedded n-gons in 3-space.*

Hu, Fang-Qiang, *Confined supersonic mixing layers: A computational investigation of instability and mixing enhancement.*

STATISTICS

Pesnell, Brett D., *Nonparametric methods for imperfect repair models.*

Proschan, Michael A., *Contributions to the theory of arrangement increasing functions.*

Ramakrishnan, Viswanathan, *Analysis of cross-classified data using negative binomial models.*

University of Florida (3)

MATHEMATICS

Davidson, Jennifer, *Lattice structures in the image algebra and applications to image processing.*

Vondracek, Zoran, *Special classes of excessive functions satisfying Harnack's principle.*

STATISTICS

Hoekstra, Robert Michael, *Asymptotically pointwise optimal stopping rules in multiparameter estimation.*

University of South Florida (4)

MATHEMATICS

Chen, Li-Chen, *On asymptotic of certain hypergeometric functions and* $6 - j$ *symbols.*

Li, Xin, *Topics in approximation theory.*

Shin, Ki-Yeon, *Zeros of M-accretive operators and abstract evolution equations in Banach spaces.*

Sinkala, Zachariah, *Existence of solutions to boundary value problems for nonlinear systems of ordinary differential equations at resonance.*

GEORGIA

Emory University (1)

MATHEMATICS AND COMPUTER SCIENCE

Robinson, David Guy, *Symmetric chain decompositions of the lattice of subspaces of a finite vector space.*

Georgia Institute of Technology (4)

MATHEMATICS

Jacquin, Arnaud E., *A fractal theory of iterated Markov operators with applications to digital image coding.*

James, Glenn E., *Models of intracavity frequency doubled lasers.*

Jones, Martin T., *Universal constants in optimal stopping theory.*

Smith, Dale Treece, *Exponential decay of resolvents of banded infinite matrices and asymptotics of linear difference equations.*

University of Georgia (5)

MATHEMATICS

Ding, Hongming, *Some results on the harmonic representation of $U(p,q)$.*

Elshamy, Maged A., *On a stochastic integrodifferential equation with respect to a semiartingale taking values in the dual of a countably Hilbert nuclear space.*

STATISTICS

Kim, Young Won, *Empirical Bayes estimation for autoregressive processes.*

Lee, Sungduck, *Large sample test for the multiplicative seasonal time series models.*

Lee, Sungho, *Laws of large numbers for $L^1(R)$.*

HAWAII

University of Hawaii (1)

MATHEMATICS

Wong, Chock You, *Lattice Varieties with weak distributivity.*

IDAHO

Idaho State University (2)

MATHEMATICS

Burgoyne, Janet, *Denseness of the generalized eigenvectors of a restricted C_p discrete operator in a Banach space.*

Kunicki, Catherine Mae, *Normal preserving linear transformations.*

University of Idaho (1)

MATHEMATICS AND STATISTICS

Lotspeich, Mark, *On some recent developments of the Cauchy-Davenport Theorem.*

ILLINOIS

Illinois Institute of Technology (2)

MATHEMATICS

Horwitz, Judith A., *Nonlinear stability of a viscous axisymmetric jet.*

Makrides, Gregoris, *Some numerical studies of tubes conveying fluids.*

Illinois State University (2)

MATHEMATICS

Benson, Carol L. Trinko, *Effect of computer instruction in finite mathematics on student achievement and attitude.*

Zander, Shirley J., *Applied mathematical module for use in a linear algebra service course.*

Northwestern University (4)

MATHEMATICS

Dinwoodie, Ian Hepburn, *Large deviations for censored data.*

Kraft, Roger, *Intersections of thick Cantor sets.*

Krishnamurti, Deepa, *Resource allocation mechanisms for finite sets.*

Snavely, Mark Richard, *Markov partitions for hyperbolic automorphisms of the two-dimensional torus.*

Southern Illinois University, Carbondale (1)

MATHEMATICS

Kocik, Jerzy, *Lie tensors.*

University of Chicago (18)

MATHEMATICS

Boisen, Paul Rudolph, *The representation theory of fully group-graded algebras.*

Buckley, Stephen Michael, *Harmonic analysis on weighted spaces.*

Burchard, Paul, *D-modules and singular varieties.*

Carlip, Walter, *Regular orbits of Nilpotent groups in non-coprime.*

Daskalopoulos, Georgios, *The topology of the space of stable bundles over a compact Riemann surface.*

Farkas, Peter, *Mathematical foundations for fast methods for the biharmonic equation.*

Iozzi, Alessandra, *Invariant geometric structures: a nonlinear extension of the Borel density theorem.*

Jabon, David Carl, *The supercuspidal representations of $U(2,1)$ and GSP_4 via Hecke algebra isomorphisms.*

Kimura, Shun-ichi, *On varieties whose Chow groups have intersection products with Q-coefficients.*

Martinez-Gamba, Irene, *Asymptotic behavior at the boundary of a semiconductor device in two space dimensions.*

Merriman, Barry Lynn, *Smooth particle methods on bonded domains.*

Perkinson, David Mark, *Jet bundles and curves in Grassmannians.*

Rich, Andrew Forrester, *A Lefschetz theorem for foliated manifolds.*

Shen, Zhongwei, *Layer potentials and boundary value problems for parabolic lame systems of elasticity and a nonstationary linearized system of Navier-Stokes equations in Lipschitz cylinders.*

Wu, Jyh-Yang, *Finiteness theorems for Riemannian manifolds and Riemannian fibre bundles.*

STATISTICS

Handcock, Mark Stephen, *Inference for spatial Gaussian random fields when the objective is prediction.*

Kolassa, John Edward, *Topics in series approximation to distribution functions.*

Rizzo, Louis P., *Predictive regression estimators of the finite population mean using functions of the probability of selection.*

University of Illinois, Chicago (11)

MATHEMATICS, STATISTICS AND COMPUTER SCIENCE

Cao, Wei, *Stability of Fredholm properties and interpolation of operators.*

Cohen, Steven M., *A geometric presentation of some fundamental modules of Chevalley groups.*

Itai, Masanori, *On strong Martin conjecture.*

Kwembe, Tor Anthony, *Nonlinear diffusion problems of mathematical biology.*

Mankus, Margo Lynn, *Asymptotic analysis of a voice-data communications model.*

Meng, Fan-Chin, *Contributions to multistate reliability theory.*

Pu, Kewei, *Contributions to fractional factorial designs.*

Siadat, Mohammad Vali, *Norm inequalities for integral operators on cones.*

Srinivasan, Murali Krishna, *Optimization problems on posets and graphs.*

Zhao, Wenxun, *Optimal repeated measurements designs.*

Zhou, KeCheng, *Norm inequalities for Lacunary series.*

University of Illinois, Urbana-Champaign (12)

MATHEMATICS

Charalambous, Hara, *On lower bounds for the Betti numbers of finite length modules.*

Chen, Mei-Qin, *The updated subspaces method in optimization and in solving linear systems of equations.*

Ellers, Harald, *Blocks and virtually irreducible lattices.*

Girardi, Maria, *Dunford-Pettis operators on L_1 and the complete continuity property.*

Holsey, Mickey Charles, *Boolean valued probabilistic metric spaces.*

Keum, Byoung Joon, *Numerical variational methods in differential geometry and applications to computer science.*

Lou, Shituo, *A new upper bound in the linear sieve and its applications.*

Sheu, Tsung-Luen, *On the nilpotent injectors of the general linear groups.*

Simon, Julie Dennery, *Bounds on the cardinalities of families of neighborly and nearly neighborly polytopes.*

Streid, David, *The computational complexity of prefix classes of logical theories.*

Sun, Ye Neng, *Nonstandard theory of vector measure.*

Zivaljevic, Bosko, *Hyperfinite transversal theory.*

INDIANA

Indiana University (6)

MATHEMATICS

Basak, Gopal Krishna, *Stability and functional central limit theorems for degenerate diffusions.*

Eden, Alp Osman, *An abstract theory of L-exponents with applications to dimensions analysis.*

Horton, Clark Dean, *Stability of nonsingular group orbits.*

Jin, Kyung-Hee, *On unbounded Bergman operators.*

Martin, Nicholas Anthony, *Special properties of Bishops's operator.*

Woodard, Mark Richard, *Invariants of surgered, sewn link exteriors.*

Purdue University (23)

INDUSTRIAL ENGINEERING

Chao, Ping-Yi, *Determination of manufacturability and machining parameters based on a new classification method for machinability.*

Drolet, Jocelyn, *Scheduling virtual cellular manufacturing systems.*

Dutta, Debasish, *Variable radius blends and Dupin cyclides.*

Gibson, David C., *Knowledge structures in human problem solving: Implication for human-interactive tasks.*

Irizarry-Lopez, Vilma, *A methodology for the automatic generation of process plans in an electronic assembly environment.*

Roy, Utpal, *Computer aided representation and analysis of geometric tolerances.*

Shodhan, Ronak, *COMAND: A computer consultant for the design, operations, and control of flexible manufacturing systems.*

Taghaboni, Fataneh, *Scheduling and control of manufacturing systems with critical material handling.*

Trafalis, Theodore, *Efficient faces of a polytope: Interior methods in multiobjective optimization.*

Trappey, Juifen, *Methodology for automatic fixture design in computer integrated environment.*

MATHEMATICS

Campbell-Wright, Randall K., *On the equivalence of composition operators.*

Chen, Jui-Hsin, *Estimates of the invariant metrics on complex domains in C^n.*

Choi, Sangki, *Betti numbers and the integral closure of ideals.*

Ghorpade, Sudhir Ramakant, *On the enumeration and independence of standard Young tableaux of higher width.*

Joshi, Sanjeevani Balkrishna, *Various correspondences between multitableaux and multimonomials.*

Marley, Thomas John, *Hilbert functions of ideals in Cohen-Macaulay rings.*

Noh, Sun Sook, *Multiplicities and reductions of adjacent integrally closed ideals in a 2-dimensional regular local ring.*

Thoma, Apostolos Thomas, *Complete intersections.*

Yang, Agnes, *A construction of Krein spaces of analytic functions.*

STATISTICS

El-Krunz, Sadi Mahmoud, *Bayesian optimal designs for linear regression models.*

Fan, Tsai-Hung, *Convolution of t-densities with application to Bayesian inference for a normal mean and scientific reporting.*

Lee, Chung-Bow, *Comparison of frequentist coverage probability and Bayesian posterior coverage probability, and applications.*

Oh, Man-Suk, *Statistical multiple integration via Monte Carlo importance sampling.*

University of Notre Dame (6)

MATHEMATICS

Gao, Weiqi, *The unimodular Monge-Ampere equation: the two dimensional case.*

Herzog, Ivo, *Some model theory of modules.*

Hurlburt, Kelleen, *Sufficiency conditions for theories with recursive models.*

Lahtonen, Jyrki, *Composition factors of induced modules.*

Leganza, Krystina Kay, *Representations of exceptional Lie algebras restricted to subalgebras.*

Ru, Min, *The second main theorem for moving targets.*

IOWA

Iowa State University (16)

MATHEMATICS

Amin, Wael A. Ahmad, *Compact posets and ramifiability of large cardinals.*

Anderson, Jeffrey R., *Qualitative studies of a convective porous medium equation with a nonlinear forcing at the boundary.*

Babakhani, Ali, *Theory of multidimensional Laplace transforms and boundary value problems.*

Coyle, James J., *The numerical solution of differential-algebraic systems using Runge-Kutta methods of special type.*

Fuh, Cheng-Der, *The bootstrap method for Markov chains.*

Tantawy, Abdalla Sayed, *Oscillation and nonoscillation of third-order functional differential equations.*

STATISTICS

Andrews, Douglas Martin, *Nonparametric analysis of unbalanced paired-comparison or ranked data.*

Davis, Paula Marie, *Evaluation and prediction of maize response to early-season injury from stalk borer.*

Funo, Eiichiro, *Proving admissibility using the stepwise Bayes technique: With applications to maximum likelihood estimation.*

Gotway, Carol Anne, *Inference from spatial processes.*

Grondona, Martin Oscar, *Design and estimation with correlated observations.*

Hulting, Frederick Landis, *Some Bayesian and non-Bayesian procedures for the analysis of comparative experiments and for small-area estimation: Computational aspects, frequentist properties, and relationships.*

Lin, Chiou-Hua, *Powers of two-sample rank tests under Lehmann alternatives.*

Sullivan, Gary Robert, *The use of added error to avoid disclosure in microdata releases.*

Symanowski, James Thomas, *Multivariate distributions with applications to logistic regression models for correlated categorical responses.*

Zakaria, Rahmat Syahni, *On the nonmonotonicity of component importance measures for linear consecutive-K-out-of-N systems.*

University of Iowa (8)

APPLIED MATHEMATICAL SCIENCES

Wills, Randall Gordon, *Resolution of the multiplicity problem for $U(N)$ using shift operators.*

Yen, Jeng, *Numerical methods for constrained equations of motion in mechanical systems dynamics.*

MATHEMATICS

Lund, Eric, *Right orders in semisimple semigroups.*

Park, Chin-Hong, *The direct product and module-like properties of automata.*

Timm, Mathew, *The local topology of some nonisolated singularities.*

STATISTICS AND ACTUARIAL SCIENCE

Dobler, Carolyn Pillers, *A class of rank multiple contrast tests for one-sided comparisons of treatments.*

Nandram, Balgobin, *Bayesian predictive inference for longitudinal and multivariate surveys.*

Rothmann, Mark, *Strong limiting bounds for statistics based on moving subsets of random variables.*

KANSAS

Kansas State University (3)

MATHEMATICS

Obeid, Mustafa Ali, *Pastings and centeria of orthoalgebras.*

Park, Eunsoon, *Path-connected ortho modular lattices.*

STATISTICS

Tafour, Aly, *Maximum likelihood estimators of regression parameters with randomly censored lifetime data.*

University of Kansas (1)

MATHEMATICS

Jenab, Albert, *Harmonic analysis on symmetric Hilbert manifolds and second quantization.*

KENTUCKY

University of Kentucky (5)

MATHEMATICS

Belshoff, Richard George, *On Matlis reflexive modules.*

Choe, Hi Jun, *Regularity for the minimizers of certain singular functionals.*

Goddard, Mark Arden, *Projective covers of complexes.*

Vogel, Andrew Lee, *Boundary regularity and symmetry for regions having a solution to certain over determined boundary value problems.*

STATISTICS

Truszczynska, Helena, *Robustness in Bayesian analysis.*

LOUISIANA

Louisiana State University, Baton Rouge (2)

MATHEMATICS

Palfrey, Thomas, *Density theorems for reciprocity equivalences.*

Ruge, Michael Helmuth, *L_p-regularity and extrapolation.*

Tulane University (2)

MATHEMATICS

Park, Mi Ai, *Model equations in fluid dynamics.*

Pickett, Douglas, *Scattering theory for higher order equations.*

University of Southwestern Louisiana (9)

MATHEMATICS

Clay, Ellen, *Semicontinuous groups*

Uvah, Josaphat, *Monotone iterative technique for nonlinear first order singular systems of differential equations.*

Wong, Benedict, *Singular parabolic boundary value problems.*

STATISTICS

Davis, Robert, *The mathematical theory of evolutionary size games.*

Hebert, Jaimie Layne, *Risk Antagonism in two-person noncooperative games.*

Laviolette, Michael James, *On the efficacy of fuzzy representations of uncertainty.*

Maine, Mary Keller, *Using order statistics to detect the number of components in a finite mixture having normal components.*

Nayebpour, Mohamad R., *Economic design of on-line quality control procedures for attribute characteristics.*

Saadat, Majid, *Estimation of parameters in a mixture of gamma distribution failure models when data are grouped.*

MARYLAND

Johns Hopkins University (6)

BIOSTATISTICS

Qaqish, Bahjat, *Multivariate regression models using generalized estimating equations.*

Waclawiw, Myron, *Extension of the Stein estimating procedure through the use of estimating functions.*

MATHEMATICAL SCIENCES

Chang, Yaw Oliver, *Network programming models for ecodevelopment global optima.*

Krass, Dmitry, *Contributions to the theory and applications of Markov processes.*

MATHEMATICS

Ishibashi, Makato, *Effective version of the Tschebotareff density theorem in function fields.*

Kameko, Masaki, *Products of projective spaces as Steenrod modules.*

University of Maryland, Baltimore (2)

MATHEMATICS

Pal, Nabendu, *Decision theoretic estimation of location and scale parameters in exponential families.*

Wang, Ping, *Homogenization of an inhomogeneous degenerate elastic material.*

University of Maryland, College Park (17)

MATHEMATICS

Chen, Kang, *An economic model of China.*

Chen, Senhuei E., *A discontinuous solution to a nonlinear elliptic-hyperbolic system.*

Draper, Patricia, *Pick-Nevanlinna interpolation on an annulus.*

Drumm, Todd A., *Fundamental polyhedra for Margulis space-times.*

Guo, Meihui, *Inference for nonlinear time series.*

Heil, Christopher Edward, *Wiener amalgam spaces in generalized harmonic analysis and wavelet theory.*

Johnson, Aimee Sue, *Measures on the circle invariant under a nonlacunary subsemigroup of the integers.*

Kerby, Rodney, *The correlation function and the Wiener-Wintner theorem in higher dimensions.*

Lee, Chin San, *Parameter estimation in branching processes with application to tumor growth.*

McElvany, Michelle Carter, *Guaranteed deadlines for hard real-time fault-tolerant distributed system.*

Nestor, Jean-Bernard, *Linear divisibility recurrence sequences and primality testing.*

Phillips, Mark Bryan, *Dirichlet polyhedra in complex hyperbolic space.*

Schwab, Christoph, *Dimensional reduction for elliptic boundary value problems.*

Swearingen, Daniel, *Graph continuity of the Cauchy-Riemann operator.*

Wang, Wen-Yu, *Statistical inference for aggregated Markov processes.*

Woo, Ching Wah, *Nonlinear P.D.E. and optimal control with integral constraint.*

Yang, George Keith, *Applications of Wiener-Tauberian theorem to a filtering problem and convolution equations.*

MASSACHUSETTS

Boston University (2)

MATHEMATICS

Odell, Patricia M., *Interval-censored outcomes and time-dependent covariates in accelerated failure time models.*

Winters, Robert, *Bifurcations in families of antiholomorphic functions in biquadratic maps.*

Brandeis University (2)

MATHEMATICS

Bremigan, Ralph Joseph, *Reductive groups, algebraic quotients, and real structures.*

Ding, Songqing, *Cohen-Macaulay approximations over Gorenstein local rings.*

Harvard University (29)

APPLIED SCIENCES

Fu, Michael Chung-Shu, *Optimization of queueing systems using perturbation analysis.*

Gereb-Graus, Mihaly, *Lower bounds on parallel, distributed, and automata computations.*

Graham, Paul, *The state of a program and its use.*

Hu, Jian-Qiang, *Strong consistency of infinitesimal perturbation analysis estimates.*

Mihail, Kalomira-Eleni, *Combinatorial aspects of expanders.*

Montgomery, Michael T., *Potential vorticity and diabatic processes in frontal dynamics.*

Myers, Joseph Dwan, *Streamwise vortices in laminar-turbulent transition.*

Neal, Lisa F., *The role of user models in system design.*

Reiter, Ehud R., *Generating appropriate natural language object descriptions.*

Zhang, Bin, *Performance gradient estimation for very large Markov chains.*

BIOSTATISTICS

Buyse, Marc Eric, *Issues of efficiency in cancer clinical trials.*

Hilton, Joan Frances, *Exact size and power of conditional tests for categorical data.*

Larholt, Kay Marice, *Statistical methods and heterogeneity in meta-analysis.*

Ng St. Louis, Jennifer, *Compartmental models of chronic disease.*

Pampallona, Sandro, 1: *Alcohol consumption and breast cancer;* 2: *Group sequential methods for clinical trials.*

Sleeper, Lynn A., *Regression spline methodology for covariate effects in the proportional hazards model.*

Walsh, Steven J., *Exact nonparametric methods.*

Wang, Fong, *Methods for analyzing longitudinal random effects models.*

MATHEMATICS

DiPippo, Stephen A., *Spaces of rational functions on curves over finite fields.*

Hildebrand, Martin, *Rates of convergence of some random processes on finite groups.*

Kouvidakis, Alexander, *Divisors on some moduli spaces.*

Lu, Steven Shin-Yi, *On meromorphic maps between algebraic varieties with log-general targets.*

Shi, Wan-Xiong, *Ricci deformation of the metric on complete noncompact Kähler manifolds.*

Shpiz, Edward, *Deligne's conjecture in the constant coefficient case.*

Stong, Richard A., *Nonexistence of almost handlebody structure on topological four-manifold pairs.*

Tan, Ki-seng, *Refined conjecture of the Birch and Swinnerton-Dyer type.*

Wang, Yang, *Image segmentation by variational method and elliptic boundary value problems.*

STATISTICS

Almond, Russell G., *Fusion and propagation of graphical Beliep models.*

Gelman, Andrew Eric, *Topics in image reconstruction for emmision tomography.*

Massachusetts Institute of Technology (24)

MATHEMATICS

Gonzalez-Barrios, Jose M., *On von Mises functionals with emphasis ontrace class kernels.*

Howell, Louis Hill, *Computation of conformal maps by modified Schwarz-Christoffel transformations.*

Huang, Rosa Huang, *Combinatorial methods in invariant theory.*

Loeb, Daniel E., *The iterated logarithmic algebra.*

Lu, Shirong, *Modular invariant representations and their applications.*

McDonald, Patrick, *The Laplacian for spaces with cone-like singularities.*

Newman, Mark J., *Randomness and robustness in hypercube computation.*

Prato, Elisa, *Some symplectic invariants of Hamiltonian K-actions.*

Purtill, Mark R., *André permutations, lexicographic shellability, and the cd-index of a converse polytope.*

Reiner, Victor Schorr, *Quotients of Coxeter complexes and P partitions.*

Sadofsky, Henry J., *The root invariant and v_1-periodic families.*

Shastri, Aditya, *On some extremal problems in combinatorics and graph theory.*

Souza, Regina P., *Multiplicity-free actions and the image of the moment map.*

Stenzel, Matthew B., *Kähler structures on cotangent bundles of real analytic Riemannian manifolds.*

Wagner, David Gustav, *Enumerative combinatorics of partially ordered sets, and total positivity of Hadamard products.*

Waleffe, Fabian A., *The* 3-D *instability of a strained vortex and its relation to turbulence.*

Wu, Siye, *Functional determinants in mathematical physics.*

Yekutieli, Amnon, *The residue complex and duality for some noncommutative rings.*

OPERATIONS RESEARCH

Caulkins, Jonathan P., *The distribution and consumption of illicit drugs: some mathematical models and their policy implications.*

Eckstein, Jonathan, *Splitting method for monotone operators with applications to parallel optimization.*

Hall, Leslie Ann, *Two topics in discrete optimization: polyhedral structure of capacitated trees and approximation algorithms for scheduling.*

Luo, Zhi-Quan, *Communication complexity of some problems in distributed computation.*

Tan, Kok-Choon, *Newton's method for parametric center problems.*

Zhang, Hongtao, *Cyclic scheduling in a stochastic environment.*

Northeastern University (3)

MATHEMATICS

Chen, Yah-Wei, *Estimation of Poisson mean under restricted parameter space.*

Lin, Hwei-Jen, *On two-dimensional isometric array grammars and applications to pattern recognition.*

Ma, Xiaoyun, *The Laplacian on complete manifolds with warped cylindrical ends and its application.*

Tufts University (2)

MATHEMATICS

Chen, Liang, *On the shadowing property for piecewise monotone maps.*

Ould-Rouis, Hamid, *Invariance principles and self-normalizations for sums trimmed according to choice of influence function.*

University of Massachusetts, Amherst (5)

MATHEMATICS AND STATISTICS

Khan, Mizan Rahman, *Computation of partial zeta values at $s = 0$ for a totally real cubic base field.*

Krone, Stephen M., *Local times for superprocesses.*

Moran, Judith F., *The role of the corona in determining global properties of homogeneous tilings in the euclidean and hyperbolic planes.*

Riedel, Thomas, *Cauchy's equations on a space of distribution functions.*

Wilce, Alexander Griffin, *The signed weight space of a tensor product.*

MICHIGAN

Michigan State University (13)

MATHEMATICS

Curtis, Frank J., *Cohen-Macauley unions of lines in P_k^n and the Cohen-Macauley type.*

Dimitric, Ivko, *Quadric representation and submanifolds of finite type.*

Nikolopoulos, Panagiotis V., *An algorithm for non-negative least error minimal norm solutions.*

Tazawa, Yoshihiko, *Differential geometry of slant surfaces.*

Yamashita, Masahiro, *Geometry of the Melnikov vector.*

Zhang-Sun, Hong, *On the Galerkin method with vector basis functions.*

STATISTICS AND PROBABILITY

Gogate, Jagadish P., *Compound estimation of parameters of right-censored exponential families.*

Gunawardena, Chitra, *Finite state k-extended set compound decision problem.*

Kinateder, John, *An invariance principle application to the bootstrap.*

Lahiri, Soumendra Nath, *Bootstrap approximations to the distributions of M-estimators.*

Perera, Priyantha Liyanage, *Behavior of a diffusion process on 2-dimensional torus with application to phase locked loops.*

Richard, Philip Henry, *Dilation of operator valued measures in Banach spaces and Harmonizable Banach spaces valued processes.*

Shi, Yingqi, *On sequential procedures based on the minimum distance estimator and robustness.*

University of Michigan, Ann Arbor (22)

BIOSTATISTICS

Ploughman, Lynn M., *Estimating the power of a proposed linkage study.*

Tan, Hsien-Jane, *A canonical approach for grouping categories in tables and other problems.*

INDUSTRIAL AND OPERATIONS ENGINEERING

Benson, Peter, *A calculus for infinite horizon optimization.*

Gan, Jacob, *Spherical algorithms for setup orientations of workpieces with sculptured surfaces.*

Houshmand, Ali, *Discriminant function analysis for autocorrelated data; Applications in cutting tool monitoring.*

Kim, David S., *Aggregation in large scale Markov chains.*

Lee, Heungsoon, *A design methodology for flexible assembly systems.*

Lifshitz, Yair, *Models of upper limp ergonomic stresses based on analysis of job attributes.*

Radson, Darrell, *Experimental design in the presence of an uncontrollable variable: model characteristics and design augmentation in a front end alignment experiment.*

MATHEMATICS

Aberbach, Ian M., *Finite phantom projective dimension and a phantom analogue of the Auslander-Buchsbaum theorem.*

Boucher, Kenneth M., *Similitudes of surface mapping class groups, and reducible outer automorphisms of free groups.*

Cochran, Webb George, *Random Blaschke products.*

Coker, Curtis Charles, *Two problems in algebraic combinatorics.*

Khodja, Mohamed, *Nonlinear stability of oscillatory traveling waves from some systems of hyperbolic conservation laws.*

Lee, Jungseob, *On the constant in the Turan-Kubilius inequality.*

Malarkey, Martin M., *Cyclotomy and block designs in cyclic neofields.*

Park, Chan-Young, *Homotopy groups of automorphism groups of some Seifert fiber spaces.*

Rickert, John H., *Simultaneous rational approximations and related diophantine equations.*

Wass, Noel C., *Algebraic independence of the values at algebraic points of a class of functions considered by Mahler.*

STATISTICS

Chang, Chienming, *Bayesian nonparametric prediction based on censored data.*

Chen, Zen-Yi, *Robust linear discriminant procedures using projection pursuit methods.*

Gunderson, Brenda Kirsten, *Estimating the dimensionality in canonical correlation analysis.*

Wayne State University (1)

MATHEMATICS

Lai, Hongyuan, *All over designs.*

Western Michigan University (3)

MATHEMATICS AND STATISTICS

Kubicka, Ewa Maria, *The chromatic sum and efficient tree algorithms.*

Kubicki, Grzegorz, *Greatest common subgraphs.*

Rao, Sudhakar, *Measures of partial association based on rank estimate.*

MINNESOTA

University of Minnesota, Minneapolis (16)

MATHEMATICS

Chen, Bin, *On singularities of a class of p-harmonic maps.*

Chen, Hwa-Nien, *On the stability of a population model with sexual reproduction on $Z^d (d \geq 2)$.*

Cooke, David Barton, *Hamiltonian systems of evolution equations.*

Finnegan, Timothy Patrick, *Siegel-Hilbert modular forms of level one over fields with narrow class number one are theta series.*

Hu, Bei, *Nonlinear problems in partial differential equations.*

Kim, DaeSan, *Galois symmetric square L-functions.*

Kim, Dongsu, *A combinatorial approach to biorthogonal polynomials.*

Norton, Douglas, *A metric approach to the Conley decomposition theorem.*

Ondich, Jeffrey Robert, *Partially invariant solutions of differential equations.*

Ouyang, Tiancheng, *On the positive solutions of semilinear equation $\Delta u + \wedge u + hu^p = 0$ on Riemannian manifold.*

Padron, Victor, *Sobolov regularization of some nonlinear ill-posed problems.*

Postol, Michael Samuel, *Realization of homotopy equivalences by homeomorphisms.*

Tabara, Tatsuhiko, *An asymptotic analysis and stokes multipliers for a second order linear differential equation with polynomial coefficients.*

Taboada, Mario, *Long-time behavior of the Kuramoto-Sivashinsky equation and related problems.*

Taylor, Stephen William, *Gevrey regularity for solutions of evolution equations and exact boundary controllability.*

Wang, Xuefeng, *On Cauchy problems for relation-diffusion equations.*

MISSISSIPPI

University of Mississippi (1)

MATHEMATICS

Mortabit, Abdes-Samad, *A periodic result for a nonlinear functional integral equation.*

MISSOURI

University of Missouri, Columbia (1)

STATISTICS

Bandyopadhyay, Dipankar, *Some univariate and multivariate problems with applications in reliability theory.*

University of Missouri, Kansas City (1)

MATHEMATICS

So, Shing Seung, *Nets and convergence spaces.*

University of Missouri, Rolla (2)

MATHEMATICS AND STATISTICS

Kuhlmann, Dietrich William, *Properties of estimators of concave regression functions.*

McKee, Rhonda L., *Semigroups of functions on nearness spaces and near completely homogeneous spaces.*

Washington University (3)

MATHEMATICS

Paulsen, William Harold, *Upper and lower bounds for the Hausdorff dimension of self-affine sets.*

Perez, Carlos, *Weighted norm inequalities for potential and maximal operators.*

Soria, Javier, *Tent spaces based on weighted Lorentz spaces. Carleson measures.*

NEBRASKA

University of Nebraska (3)

MATHEMATICS AND STATISTICS

Diaz, Gerald, *Applications of cone theory to boundary value problems.*

Goddard, Bartley Earl, *A finite Dirichlet series related to Newman polynomials.*

Peil, Timothy Scott, *Criteria for disconjugacy and disfocality for an nth-order linear difference equation.*

NEW HAMPSHIRE

Dartmouth College (1)

MATHEMATICS AND COMPUTER SCIENCE

Stellpflug-Mandych, Karen Marie, *Discrete representations of semiorders.*

NEW JERSEY

Princeton University (10)

MATHEMATICS

Demichelis, Stefano, *Group actions on four-dimensional manifolds.*

Fisher, Benji, *Distinctness of Kloosterman sums.*

Hu, Sen, *A proof of C^1 stability for 3-dimensional flows.*

Kenyon, Richard, *Self-similar tilings.*

Pan, Yibiao, *Estimates for oscillatory singular integral operators.*

Rognes, John, *The rank filtration in algebraic K-theory.*

Schramm, Oded, *Packing two-dimensional bodies with prescribed combinatorics and applications to the construction of conformal and quasiconformal mappings.*

Seco, Luis Angel, *Lower bounds for the ground state energy of atoms.*

Silverman, Judith Hava, *Subgroup conditions for groups acting freely on products of spheres.*

Smith, Hart Francis, *The subelliptic oblique derivative problem.*

Rutgers University, New Brunswick (19)

MATHEMATICS

Hurlbert, Glenn, *Universal cycles: On beyond DeBruijn.*

Husu, Christiano, *Extensions of the Jacobi identity for vertex operators and standard $A_1^{(1)}$-modules.*

Kang, Seong Joo, *Conormal and piecewise smooth solutions to quasilinear wave equations.*

Karwowski, Andrzej Joachim, *Asymptotic models for a long elastic cylinder.*

Ostapenko, Peter, *Gevrey completions of enveloping algebras and Whittaker maps for semisimple Lie groups.*

Petersen, Johannes Asmus, *On the hypoellipticity of the tangential Cauchy-Riemann operator.*

Prevost, Shari, *Vertex operators and integral bases of affine Lie algebras.*

Rodriguez-Carrington, Enriqueta, *Kac-Moody groups: An analytic approach.*

Rosenbaum, Zangwill, *Foundations and techniques of dimensional analysis.*

Ross, Raymond A., *K_2 of elliptic and Fermat curves.*

Tesman, Barry Allen, *T-colorings, list T-colorings, and set T-colorings of graphs.*

Wehr, Jan, *Effects of quenched randomness in statistical mechanics.*

Wysocki, Krzysztof, *Weak and strong ergodicity for solutions of ordinary differential equations.*

STATISTICS

Doll, Jeanne Marie, *Empirical Bayes estimation in contingency tables with constrained margins.*

Hsu, Yu-Sheng, *On conditional discrete density estimation.*

Messig, Michael Anthony, *Estimation in dichotomous quantal response models.*

Pickering, Evelyn Hannah, *Patterns of identity by descent in a stochastic mating system.*

Tappin, Linda Anne, *Estimation of the parameter of a selected binomial population.*

Zhang, Zhi Yi, *Recovery of interblock information in a balanced incomplete block design with interaction.*

NEW MEXICO

New Mexico State University (4)

MATHEMATICAL SCIENCES

Losta, Mansor, *Numerical methods for solving singular perturbation problems appearing in elasticity and radiative transfer.*

Merrin, Christine Rossi, *Simply presented valuated modules.*

Merrin, Stephen D., *Some constructive results in the elementary theory of Lie algebras.*

Peeples, Joanne V., *Oligopoly.*

University of New Mexico (2)

MATHEMATICS AND STATISTICS

Fahimi, Mansour, *Optimal integration of surveys and controlled selection.*

Tapia-Aguilar, Julian, *Stochastic analysis of the channeling problem.*

NEW YORK

Adelphi University (2)

MATHEMATICS AND COMPUTER SCIENCE

Glass, Richard, *Polarizability of the hydrogen atom by an electric field.*

Harding, Nicholas James, *The nerve impulse and mathematical models of neurons.*

CUNY, Graduate Center (4)

MATHEMATICS

Isaacs, Frank D., *Commutation and deficiency indices: Comparing t^*t and tt^*, where t is an ordinary differential operator with smooth coefficients.*

Jia, Xing-De, *Some results in additive number theory.*

Jiang, YunPing, *Generalized Ulam-von Neumann transformations.*

Wang, Ming, *AD-C.R. geometries in dimension 4.*

Clarkson University (3)

MATHEMATICS AND COMPUTER SCIENCE

Abu-Jaradeh, Nafiz D., *Differential equations on graphs.*

Bier, Martin, *Singularity analysis of chaotic behavior and related problems of nonlinear dynamics.*

Bradie, Brian David, *Comprehensive simulation of photolithographic processes in two and three dimensions.*

Columbia University (9)

STATISTICS

Li, Zhaohai Li, *Asymptotically optimal sequential allocation rules.*

Tang, Mingxin, *Statistical analyses for doubly-censored data.*

MATHEMATICS

Chace, Charles Everette, *The number of ways of writing an integer as a sum of three products of ℓ factors .*

Chen, Jianer, *Distributional properties of graph embeddings on topological surfaces.*

Falbel, Elisha, *Nonembeddable CR manifolds and surface singularities.*

Lockhart, Paul Thomas, *Diophantine equations and the arithmetic of hyperelliptic curves.*

Trapp, Rolland John, *Applications of crossed-homomorphisms of the mapping class group M.*

Wentworth, Richard Alan, *Asymptotics of the Arakelov-Green's function and Faltings' delta invariant.*

Xu, Peijun, *Applications of cyclic presentation of braid groups and the growth of positive braid semigroups.*

Cornell University (31)

APPLIED MATHEMATICS

Crone, Brian James, *Existence of equilibria in incomplete information games with disturbed payoffs.*

Hempel, Christian George, *A globally convergent quadratic penalty function method with fast local convergence properties.*

Hulbert, Laurie Ann, *Solving large sparse quadratic programs with simple bounds.*

Kiemel, Tomothy Lee, *Three problems from the mathematics of neural oscillations.*

Plassmann, Paul Eugene, *The parallel solution of nonlinear least-squares problems.*

BIOMETRICS

Stehman, Stephen Victor, *On the variance and variance estimators of the Horvitz-Thompson estimator for variable probability systematic sampling.*

MATHEMATICS

Bianco, Steven Anthony, *A stochastic epidemic in a large population.*

Brittenham, Mark William, *Essential Laminations in Seifert-Fibered spaces.*

Fisher, Yuval, *The classification of critically preperiodic polynomials.*

Lee, Ping, *On the vector-scalar potential formulation of the three-dimensional eddy current.*

Lin, Ming, *The convergence of $U_{(1)}$ gauge theory on random lattices in three dimensions.*

Lipton, James B., *Relating Kripke models and realizability.*

McCarthy, Randolph, *Cyclic homology of an exact category.*

Neuhauser, Claudia, *Ergodic theorems for the multitype contract process.*

Noble, Christopher Francis, *Equilibrium behavior of the sexual reproduction process.*

Wijesekera, Duminda, *Constructive modal logics.*

Zhang, Yu, *A power law for connectedness of some random graphs at the critical point.*

OPERATIONS RESEARCH

Loerch, Andrew, *A new approach to production planning, scheduling, and due-date quotation in manufacturing systems.*

Sewell, Edward C., *Stability critical graphs and the stable set polytope.*

Shallcross, David Frank, *Two investigations in combinatorial optimization: approximate solution of large traveling salesman problems arising from x-ray diffraction experiments; relatively transitive subgraphs.*

Shum, Henry, *Chains of bounded length and antichains of bounded width in partially ordered sets.*

Tate, David, *Due-date based performance measures in dynamic stochastic manufacturing systems.*

Yamagami, Shin, *Generalized linear models.*

Yucesan, Enver, *Simulation graphs for design and analysis of discrete event simulation models.*

Zhu, Yixin, *Markov-modulated stochastic storage processes.*

STATISTICS

Behaxeteguy, Maika Marie-Francoise, *Two-stage selection procedures with bounded selected subset size in the first stage.*

Forbes, Andrew Benjamin, *Asymptotic properties of log odds ratio regression estimators with sparse strata and covariate measurement error.*

Goutis, Constantinos, *Improved invariant set estimation of a normal variance with generalizations.*

Greenshtein, Eitan, *On some decision theory problems in sequential analysis.*

McShane, Lisa Meier, *Statistical quality control procedures for monitoring laboratory analyses.*

Ngwengwe, Alasford Mapulanga, *Measures of association for two-way tables of continuous or binary data.*

New York University, Courant Institute (24)

MATHEMATICS

Affouf, Mahmoud, *Numerical study of dynamic phase transitions for a system of conservation laws of mixed type.*

Braga, Gastao de Almeida, *The two-dimensional lattice coulomb gas at low temperature.*

Bruno, Oscar, *The effective conductivity of an infinitely interchangeable mixture.*

Cai, Xiao-Chuan, *Some domain decomposition algorithms for non-self-adjoint elliptic and parabolic partial differential equations.*

Chang, Chih-Chung, *Nonequilibrium fluctuations for a system in hydrodynamic scaling.*

Davidow, Amy Lynne, *On Casson's invariant of branched cyclic covers over S^3.*

Furtado, Frederico, *Structural stability of nonlinear waves for conservation laws.*

Gleason, Stewart Hart, *Hessian determinants of harmonic functions.*

Grotowski, Joseph Francis, *Harmonic maps with symmetry.*

Han, Zhengchao, *On some nonlinear ordinary and differential equations.*

Kan, Pui Tak, *On the Cauchy problem of a 2×2 system of nonstrictly hyperbolic conservation laws.*

Li, Congming, *Some qualitative properties of fully nonlinear elliptic and parabolic equations.*

Maesumi, Mohsen, *Approximate scale breaking nonlinear elementary waves for two-phase incompressible flow in porous layered media.*

Mathew, Tarek, *Domain decomposition and iterative refinement methods of mixed finite element discretizations of elliptic problems.*

Nesi, Vincenzo, *Extremal microgeometries for polycrystalline composites.*

Noelle, Sebastian, *Cauchy problems for the complex Burgers Equation in one- and two-space dimensions.*

Quastel, Jeremy, *Diffusion of colour in the simple exclusion process.*

Rezakhanlou, Fraydoun, *Hydrodynamic limit for a system with finite range interactions.*

Schirmer, Pedro, *Global existence for spherically symmetric Yang-Mills fields on IR 3+1.*

Siegel, Michael, *An analytical and numerical study of singularity formation in the Rayleigh-Taylor problems.*

Sneyd, Alfred James, *Construction and analysis of a model for phototransduction in turtle coves.*

Sorets, Eugene, *Positive Lyapunov exponents for Schrödinger operators with quasi-periodic potentials.*

Tu, Cheng, *A study of stability in the computation of flows with moving emersed elastic boundaries.*

Wang, Lihe, *On the regularity theory of fully nonlinear parabolic equations.*

Rensselaer Polytechnic Institute (6)

DECISION SCIENCES AND ENGINEERING SYSTEMS

Alloway, James A., Jr., *Robust and nonparametric quality control methods with extensions to the bivariate case.*

Beam, Kevin M., *Constructive multivariate methods for data anlaysis and modeling.*

Hussain, Hidayat, *An experimental investigation of the interaction between displays and models in multiple-criteria decision support.*

Makuch, William M., *Optimizing the collection of delinquent consumer credit.*

Park, Tae Hoon, *A bivariate Pareto Distribution characterized by linear memory.*

MATHEMATICAL SCIENCES

Wagner, Barbara, *Optimum hypersonic airfoils with attached shocks.*

SUNY at Albany (3)

MATHEMATICS AND STATISTICS

Bonner, David, *Circle actions on simply connected five-manifolds.*

Fontaine, Anne, *Polyomino frames and the Heesch problem.*

Rajia, Abbess, *New class of nonparametric rate function estimates under censored and uncensored cases.*

SUNY at Binghamton (4)

MATHEMATICAL SCIENCES

Chen, Maiwei, *Contributions to estimation theory of LLPD time series.*

Holmes, M. Randall, *Systems of combinatory logic related to Quines "new foundations".*

Morse, Robert F., *Levi-properties in groups.*

Yeh, George Fangchou, *Closed subclasses of M-groups.*

SUNY at Buffalo (9)

MATHEMATICS

Ibbotson, Jeffrey James, *The range of convolution operators in spaces of generalized distributions.*

Lu, Zhu-Qi, *Gevrey regularity and growth of solutions of convolution equations.*

Rajan, Dayanand Sundara, *Differentiation and integration of the combinatorial species of Joyal.*

Shih, Chih-wen, *On a priori estimates of nonlinear stability in spherically symmetric stellar dynamics.*

Tripathi, Amitabha, *Topics in number theory.*

STATISTICS

Brunner, Lawrence Jerome, *Bayes procedures for elliptically symmetric unimodal densities.*

Oh, Changhyuck, *Estimation using discrete observations in the simple stochastic epidemic and the birth and death process.*

Park, Hyo-Ill, *Bivariate control median tests for complete and right-censored data.*

Park, Sang-gue, *Nonparametric tests for the simple tree alternatives.*

SUNY at Stony Brook (15)

APPLIED MATHEMATICS AND STATISTICS

Chlouverakis, Gregory, *Imperfect repair and maintenance of stochastically failing systems.*

Chuang, Stella RweiJu, *The bivariate normal distribution: Statistical properties of the likelihood ration test for a mixture.*

Joh, Teng-Sheng, *The performance of factor analysis on linear recursive path models.*

Rispoli, Fred Joseph, *On transportation and (0, 1)-polytopes: Extreme points and diameters.*

Zhu, Jianping, *On the history matching for three-dimensional multi-phase reservoir models.*

MATHEMATICS

Chen, Haiwen, *A rigidity theorem for $\mathbf{CP}^m$ and 4-manifolds with 2-nonnegative curvature operators.*

Ciriza, Eleanora, *The symplectic structure of submanifolds of Kähler manifolds of nonpositive curvature.*

Dai, Xianzhe, *Adiabatic limit, nonmultiplicativity and Leray spectral sequence.*

Dolan, Peter C., *Spanning structures and undecidability in random graphs.*

Lima Filho, Paulo, *Homotopy groups of cycle spaces.*

Payne, Kevin Ray, *Smooth-tame Fréchet algebras and Lie groups of pseudodifferential operators.*

Polin, Lawrence, *Pseudo-differential operators on nilpotent Lie groups with dilations.*

Pontecorvo, Massimiliano, *On twistor spaces of anti-self-dual Hermitian surfaces.*

Thornber, Mark, *Vanishing theorems for quantrionic Kähler manifolds.*

Wei, Guofang, *Aspects of positively Ricci curved spaces: New examples and the fundamental group.*

Syracuse University (3)

MATHEMATICS

Anderson, Vivian, *Women in engineering programs: a qualitative study.*

Enos, Michael John, *Angular momentum optimization of rigid body trajectories.*

Tinto, Patricia Price, *Students' views on learning proof in high school geometry: An analytic-inductive approach.*

University of Rochester (6)

MATHEMATICS

Dong, Xiaoying, *Families of functions whose Julia set is* **C** *and some related results.*

Ravi, M. S., *Regularity of non-reduced ideals.*

STATISTICS

Acuna, Edgar, *Modality of mixtures of distributions.*

Choi, Sungsub, *On asymptotically optimal tests..*

Kollia, Georgia, *A study of some quantile function families: Isotones and other applications.*

Manatunga, Amita, *Inference for multivariate survival distribution generated by stable frailties.*

NORTH CAROLINA

Duke University (4)

MATHEMATICS

Grassi, Antonella, *Minimal models of elliptic threefolds.*

Landsberg, Joseph Montague, *Minimal submanifolds defined by first order systems of PDE.*

McLean, Robert Cochrane, *Deformations and moduli of calibrated submanifolds.*

Shin, Dong Kwan, *Pluricanonical maps of threefolds of general type.*

North Carolina State University, Raleigh (14)

MATHEMATICS

Chang, Yu-Hsien, *Dichotomies for abstract reaction-diffusion equations.*

Kim, Chul, *A classification of the finite rings with unity by computable means.*

Li, Hui, *Rings with infinite sums.*

Li, Zhongshan, *The embedding of rings in regular rings and π-regular rings.*

Marquardt, Vera Katharina, *Factoring the group of units of a ring.*

Yakubu, Abdul-Aziz, *Global stability, bifurcation, and chaos in discrete competitive systems.*

STATISTICS

Chang, Ming-Chun, *Testing for overdifference.*

Cook, John R., *Estimators for the errors-in-variables problem in the ordered categorical regression model.*

Gumpertz, Marcia L., *Simple estimators for the linear random coefficient regression models and the nonlinear model with variance components.*

Martinez, Stephen W., *The optimal dynamic hedging positions for grain producers before harvests: A case study.*

Udevitz, Mark S., *Change-in-ratio methods for estimating the size of closed populations.*

Wolfinger, Russell D., *Rates of convergence and asymptotic normality in semi-nonparametric regression.*

Zhang, Ji, *Bootstrap methods for tests about covariance matrices.*

Zhu, Jun, *Genetic variance components in the general mixed model.*

University of North Carolina, Chapel Hill (19)

BIOSTATISTICS

Barakat, Ali Said, *A nonparametric multivariate test for homogeneity based on all nearest neighbors.*

Carr, Gregory John, *Dose-response models in quantal response teratology.*

Cheng, Yue Mei, *A modified score test for highly stratified survival data in randomized clinical trials.*

De Leon-Wong, Emelita, *An empirical assessment of two compensation strategies for nonresponse in a panel survey.*

Flyer, Paul Alan, *Finite population correction for replication estimates of variance.*

Malott, Carolin M., *Maximum likelihood methods for nonlinear regression models with compound-symmetric error covariance.*

McMahon, Robert Patrick, *Analysis of nonfatal outcomes in clinical trials in which mortality is present.*

Murray, Sharon Cornell, *Linear models with generalized* AR (1) *covariance structure for irregularly-timed data.*

Potter, Francis J., *Methods for extreme weights in sample surveys.*

Williams, Paige Leigh, *Analytic expressions for maximum likelihood estimators in a nonparametric model of tumor incidence and death.*

MATHEMATICS

Peterson, Gregory, *Total cohomology classes of the local bicomplex.*

OPERATIONS RESEARCH

Curet, Norman David, *Solving large linearly constrained optimization.*

STATISTICS

Benhenni, Karim, *Sampling designs for estimating integrals of stochastic processes.*

Chu, Chih-Kang, *Some results on nonparametric regression.*

Crowell, John Irving, *On sequential estimation of the renewal function, optimal block replacement policies, and fixed-width confidence bands.*

Murphy, Susan, *Time-dependent coefficients in a Cox-type regression model.*

Nakamura, Miguel, *Transformations to symmetry in the transform-both-sides regression model.*

Roginsky, Allen Leonid, *On the central limit theorems for the renewal and cumulative processes.*

Stromberg, Arnold, *Robust efficient estimation of nonlinear regression parameters.*

NORTH DAKOTA

North Dakota State University (1)

MATHEMATICS

Obert, David G., *On the exact estimates of exponential dichotomy roughness.*

OHIO

Air Force Institute of Technology (1)

MATHEMATICS AND STATISTICS

Sultan, Ahmed, *Applications of nonparametric density estimation.*

Bowling Green State University (5)

MATHEMATICS AND STATISTICS

Amey, Alphonse K. A., *Robustness study of certain multivariate test criteria when sampling from a contaminated normal model.*

Chao, Chi-Chin, *Inference about covariance matrices under repeated measurements model.*

Fernando, Thotage S. A., *Special topics in univalent and multivalent functions.*

Maroli, John A., *Tree permutation groups.*

Ofori-Nyarko, Samuel, *Improved estimation of the covariance matrix, the precision matrix and the generalized variance.*

Case Western Reserve University (2)

OPERATIONS RESEARCH

Hung, Rudy Ka Yiu, *Hierarchical workforce scheduling.*

Rabinowitz, Gad, *Quality control of multistage production systems.*

Kent State University (1)

MATHEMATICAL SCIENCES

Marouf, Mousa Said, *Summability matrices that preserve various types of sequential equivalence.*

Ohio University (5)

MATHEMATICS

Coutant, Basil W., *Cardinal function dualities between a space* X *and its continuous real-valued functions.*

Gunawardena, Ananda D., *Nonnegative matrices and applications to linear systems.*

Miller, Edward Stephen, *Isocompactness properties characterized by maximal open ideals.*

Wu, Daxin, *Some results for the two-dimensional Korteweg-deVries equations.*

Yaacob, Yusof Bin, *Periodic solutions of some functional differential equations with state-dependent delays.*

Ohio State University (23)

MATHEMATICS

Andaloro, Paul, *On simplicity of certain infinite-dimensional Lie algebras.*

Bajnok, Bela, *Construction of spherical t-designs.*

Banaszak, Gryzegorz, *Algebraic K-theory of number fields and rings of integers and the Stickelberger ideal.*

Bolinger, Karen, *Pointwise closure models for slender nonNewtonian.*

Chen, Hua, *The localization theorems of S^3-equivalent cohomologies.*

Chilakamarri, Kiran Babu, *Unit-distance graphs in Euclidean spaces.*

Gajda, Wojciech, *On epicyclic sets.*

Kwok, Wing Man, *Character tables of association schemes of affine type.*

Lee, Doobum, *Contributions to rational homotopy theory of S^1 spaces.*

Lovric, Miroslav, *Ln+2/2-curvature pinching.*

Oporowski, Bogdan Stanislaw, *On Seymour's self-minor conjecture for infinite graphs.*

Peric, Goran, *The eta invariant on foliated manifolds.*

Schram, Erin, *T-designs on vector spaces over finite fields.*

Song, Yongjin, *Hermitian algebraic K-theory and dihedral homology.*

Wu, Fang Bing, *The index theorem for manifolds with cylindrical and elliptic value problems.*

STATISTICS

Bunge, John, *Distribution theory for record statistics from random record models.*

Chang, Yueh-Jane, *Optimal block designs with nested rows and columns.*

Chen, Yuh-Ing, *Nonparametric procedures for structured effects in analysis of variance.*

Hshieh, Paul B., *Estimation of the survival function for type* II *censoring.*

Park, Dong-Kwon, *Construction and efficiencies of multi-dimensional designs.*

Peng, Nanfu, *Birth and death processes with disastus.*

Soong, Wen-Chang, *On multiple comparisons for complex experimental designs.*

Wei, FeiFei, *Optimal intergenotypic competition designs and optimal weighing designs.*

University of Cincinnati (5)

MATHEMATICAL SCIENCES

Fan, Guangwei, *Existence and stabilities of positive solutions of degenerate and periodic reaction-diffusion systems.*

Moena, Ricardo, *Bifurcation of periodic points in a lattice of coupled logistic maps.*

Roth, Constance, *An integral solution approach for the inverse heat conduction problem.*

QUANTITATIVE ANALYSIS AND INFORMATION SYSTEMS

Hsu, Chyi-Hung, *A study of heteroscedastic anova models and a multivariate test for heteroscedasticity.*

Pratsini, Eleni, *The capacity constrained lot sizing problem with process and set up learning.*

OKLAHOMA

Oklahoma State University (4)

MATHEMATICS

Capehart, Steven Russell, *Techniques for accelerating interative methods for the solution of mathematical problems.*

STATISTICS

Faries, Douglas Evan, *A new sequential approximation method.*

Fei, Wuchen, *A new method for the Robbins-Monro stochastic approximation procedure.*

Mohd Nor, Abu Hassan Shaar, *The effect of initial classification on outlier testing in a linear model of constant intraclass correlation.*

University of Oklahoma (4)

BIOSTATISTICS AND EPIDEMIOLOGY

Davis, Alan Berry, *Subset selection of high rate counties.*

Torres, Carl G., *Epidemiology of nosocomial infections in ten Oklahoma hospitals: A four year study.*

MATHEMATICS

Davis, Bradford Dion, *The effect of equivalent models on specification searches in covariant structure modeling.*

Millsbaugh, Richard Paul, *Dimension and mappings.*

OREGON

Oregon State University (9)

MATHEMATICS

Andersen, Robert Nels, *Homotopy construction techniques applied to the cell-like dimension raising problem and to higher-dimensional dunce hats.*

Bodvarsson, Gudrun Marianne, *Solutions to some linear evolutionary systems of equations: A study of the double porosity model of fluid in fractured rock and its applications.*

Shea, Edward Carl, *Minimal simultaneous embeddings of central simple algebras.*

STATISTICS

Bedier, Mostafa, *Post-stratified estimation using a kown auxiliary variable.*

Bolouri, Maryam, *Network models with generalized upper bound side constraints.*

Ganio, Lisa Maria, *Diagnostic tools for overdispersion in generalized linear models.*

Hall, Katherine B., *Economically optimal control charts for two stage sampling.*

Sauter, Roger Mark, *A method for estimation of generalized linear models when explanatory variables contain measurement error.*

Viroonsri, Boonchai, *Estimation of totals for skewed populations in repeated agricultural surveys.*

University of Oregon (5)

MATHEMATICS

Asiry, Mansour, *On optimal monosplines with a maximal number of zeros.*

Holte, Sarah Elizabeth, *Some characterizations of Peano continua as images of dendrites.*

Mooney, Lesley Jones, *Massey products, lower central series and Fox derivatives.*

Randolph, Timothy W., *Spectral theory in Banach algebras related by a continuous homomorphism.*

Volpert, Klaus Ernest, *On the cohomology of transitive Lie algebras.*

PENNSYLVANIA

Carnegie-Mellon University (11)

MATHEMATICS

Haidar, Salim Mohammad, *The Lavrentiev phenomenon in nonlinear elasticity.*

Harche, Farid, *Studies on set covering, set partitioning and vehicle routing problems.*

Hou, Lisheng, *Analysis and finite element approximation of some optimal control problems associated with the Navier-Stokes equations.*

Meir, Amnon J., *Existence, uniqueness and finite element approximations of solutions of the equations of stationary, incompressible MHD.*

Messaoudi, Salim, *On local existence and formation of singularities in nonlinear thermoelasticity.*

Samelson, Sandra L., *Tchebychev nets on two dimensional Riemannian manifolds.*

Xu, Gan-Lin, *A duality approach to a Stochastic consumption/portfolio decision problem in a continuous time market with short-selling prohibition.*

STATISTICS

Epstein, Leonardo David, *Bayesian estimation in multidimensional contingency tables.*

Kim, Chul Eung, *Stochastic modeling of incarceration processes.*

Kim, Sung-Ho, *Construction of and interpretation from decision-support trees.*

Rossman, Allan Joseph, *A Bayesian approach to tournament design.*

Drexel University (3)

MATHEMATICS AND COMPUTER SCIENCE

Clavner, Hannah, *The acoustic profile reconstruction of a Lossy one-dimensional medium.*

McLeod, Douglas Scott, *A new interior point algorithm for fractional linear programs.*

Ringel, Emanuel, *A stochastic analysis of state transitions in an air space management system.*

Pennsylvania State University (13)

MATHEMATICS

Chou, Wun-Seng, *Permutation polynomials on finite fields and their combinatorial applications.*

Chun, Seon Ae, *On the theory of blocks with modules.*

Hansen, Carsten Bo, *The Jacobson radical of certain group rings.*

Harnchoowong, Ajchara, *On the L-sylow subgroups of the ideal class groups module F.*

Lee, Hee-Jung, *Maximal orders in non-associative quantention algebras.*

Weiss, Tomasz, *Martin's Axiom for σ-centered partial orders and some properties of special subsets of the set of real numbers.*

Yan, Pei-Yuan, *Lower bound techniques in parallel computation.*

STATISTICS

Furman, William, *A moment matrix approach to the inferential problems of normal mixtures.*

Grego, John, *Some extensions of the random effects Rasch model.*

Johnson, Keith L., *Higher order antedependence models.*

Kissinger, Terry, *Using distribution-function metrics to measure the rate of convergence of the transient distribution to the steady-state distribution in an M/M queue.*

Kundu, Debasis, *Some results in estimating the parameters of exponential signals in noise.*

Naranjo, Joshua, *Bounded-influence regression: A modified Wilcoxon.*

Temple University (3)

STATISTICS

Chan, Wai-sum, *Some robust methods for time series modeling.*

Lee, Jong-Hyup, *Outlier analysis in time series.*

Vakil, Ahmad Farough, *Non-adaptive group-testing procedure for the hypergeometric problem.*

University of Pennsylvania (5)

MATHEMATICS

Cao, Jianguo, *Applications of singular differential equations to Riemannian geometry.*

Coll, Vincent E., Jr., *Universal deformation formulae.*

Jin, Zhiren, *Three problems concerning the elliptic equations and systems.*

Talvacchia, Janet C., *Prescribing the curvature of a principal bundle connection.*

Zito, Jennifer Snyder, *$\{\alpha, c\}$-critical graphs.*

University of Pittsburgh (9)

BIOSTATISTICS

Bush, James R., *A nonparametric method for evaluating a diagnostic test using a minimax criterion.*

Fu, John Lieo-hu, *Nonparametric regression with right-censored lifetime data by Buckley-James least squares method—improvements and statistical inference.*

Zhou, Yujing, *Investigation of robustness of dose-response relationship in occupational health studies.*

MATHEMATICS AND STATISTICS

Chen, Chih-Sheng, *On the age and block replacement policies with or without discounting.*

Fioravanti, Mario A., *Yang-Mills fields and hypersurface twistors.*

Gale, Sherry Louise, *Measure-compact spaces.*

Gao, Ji, *The geometry and the normal structure in Banach spaces.*

Wu, Yuehua, *Asymptotic theory of minimum L_1-norm estimates and M-estimates in linear models.*

Zhang, Hong, *Symmetries in graphs.*

RHODE ISLAND

Brown University (11)

APPLIED MATHEMATICS

Cai, Wei, *Non-oscillatory spectral methods for shock computation.*

Desai, Mihir, *Computation in optimal control of steady state Navier-Stokes equations.*

Jiang, Xinming, *Augmented Lagrangian method for impedance computed tomography.*

Leader, Jeffery James, *The generalized theodorus iteration.*

Manbeck, Kevin Monroe, *Bayesian statistical methods applied to emission tomography with physical phantom and patient data.*

Martins, Luiz Felipe S., *Limit theorems for networks of queues in heavy traffic: Routing control and average cost per unit time.*

Mikami, Toshio, *Small random perturbations of dynamical systems and Markov processes from marginal distributions.*

Shin, Hyundoo, *Chaotic sedimentation of nonspherical particles in a cellular flow field.*

MATHEMATICS

Hironaka, Eriko, *Abelian coverings of CP^2 branched along configurations of real lines.*

Johnson, Ockle E., III, *Chain level Whitney duality theorems for simplicial manifolds.*

Park, Hwasin, *Idempotent relations and the conjecture of Birch and Swinnerton Dyer.*

University of Rhode Island (1)

MATHEMATICS

Kuruklis, Spiridon, *Oscillatory and asymptotic behavior of certain difference equations.*

SOUTH CAROLINA

Clemson University (4)

MATHEMATICAL SCIENCES

Barrett, Bruce Edward, *Variable selection and influence diagnostics in multivariate regression.*

Bowers, Melissa Cauthen, *A hierarchical model for production planning.*

Narayanan, Chandrasekharan, *Fase Parallel algorithms and enumeration techniques for partial K-trees.*

Ramsier, Steven Wayne, *Graphical representations of multivariate data.*

University of South Carolina (5)

MATHEMATICS

Hu, Yingkang, *Geometric modelling of densely distributed data.*

Wu, Ming-Shen, *Spanning trees and other problems.*

Yeh, Roger K. C., *Labeling graphs with a condition at distance two.*

STATISTICS

Hsi, Hsiu-Li, *Techniques and results for the analysis of mixture problems.*

Yang, Miinshen, *On limit theorems of the fuzzy C-means clustering procedure.*

TENNESSEE

Memphis State University (2)

MATHEMATICAL SCIENCES

Chu, Yu-Chao, *Generating asymptotically independent uniform random vectors.*

Gibi, Debra Jane, *Sufficient neighborhood conditions for a class of D-chromatic subgraphs.*

University of Tennessee (3)

MATHEMATICS

Anderson, Terry G., *A theory of relative boundedness and relative compactness for ordinary differential operators.*

Emert, John Wesley, *"Twisted" lens spaces.*

McKinney, William R., *Optimal error estimates for high order Runge-Kutta methods applied to evolutionary equations.*

Vanderbilt University (4)

MATHEMATICS

Hall, Gary C., *An age-size cell model with asymptotic exponential periodicity in the asymmetric case.*

Lukacs, Erzsebet, *Related structures of groups.*

Wiener, Howard William, *On an exterior Laplace equation problem with Robin boundary condition.*

Yu, Xingxing, *Contractible edge covers in 3-connected graphs.*

TEXAS

Rice University (6)

MATHEMATICAL SCIENCES

Dobson, David Clark, *Stability and regularity of an inverse elliptic boundary value problem.*

Williamson, Karen Anne, *A robust trust region algorithm for nonlinear programming.*

MATHEMATICS

Chang, Sheun-Cheng, *Critical Riemannian metrics.*

Jones, Kerry Nelson, *Cone manifolds in 3-dimensional topology: Applications to branched covers.*

Lu, Ning, *Surface mapping classes and Heegaard decomposition of 3-manifolds.*

Mou, Libin H., *Some existence and uniqueness results of harmonic maps.*

Southern Methodist University (5)

COMPUTER SCIENCE AND ENGINEERING

Allen, David, *The design and implementation of the improved link* II *simulation model.*

Wang, Zhiming, *Shortest augmenting path algorithms for network problems.*

MATHEMATICS

Bogacki, Przemyslaw, *Efficient Runge-Kutta pairs and their interpolants.*

Paprzycki, Marcin, *Parallelization of boundary value problems software.*

STATISTICAL SCIENCE

Carrillo-Gamboa, Olivia, *Measurement error model collinearities.*

Texas A & M University (7)

MATHEMATICS

Arias, Alvaro, *Topics in Banach space theory.*

Kim, Young Sook, *Finite element methods for boundary value problems of mixed type.*

Lai, Ming-Jun, *On construction of bivariate and trivariate vertex splines on arbitrary mixed grid partitions.*

Watret, John Robert, *On dynamic transient anti-plane shear crack propagation in a general viscoelastic layer.*

STATISTICS

Ensor, Joe Edward, *A two-compartment, irreversible flow model with clustering.*

Kim, Jong-Duk, *Construction of restricted D-optimal designs for simple polynomial regression models.*

Muehsam, Mitchell J., *Comparison of correspondence analysis to classical statistical methodology.*

Texas Tech University (7)

MATHEMATICS

Ayoubi, Isam S., *An inverse scattering problem for hyperbolic systems of first order in semi-infinite media.*

Chen, Dafeng, *Some nonparametric methods in estimating the hazard rate function.*

Esparza, Sergio O., *Discrete multistate coherent systems and the three modules theorem.*

McConn, Kelly, *Accelerated life testing with several type* II *censored samples.*

Obeyesekere, Mandri N., *A porous media problem arising in the study of water transport in soil and roots.*

Wang, Hsing Yong, *On zeros of partial sums of a mapping of the unit disk onto a sector.*

Xie, Shishen (Sam), *Observability of Laplace's equation on the cylindrical domain.*

University of Houston (2)

MATHEMATICS

Cook, Michael William, *Periodic points for mapping of the circle and other locally connected continua.*

Insall, Eugene Madison, Jr., *Nonstandard methods and finiteness conditions in algebra.*

University of North Texas (3)

MATHEMATICS

Hipp, James William, Jr., *The maximum size of combinatorial geometries excluding wheels and whirls as minors.*

Park, Hong Goo, *Polynomial isomorphisms of Cayley objects over a finite field.*

Spear, Donald W., *Hausdorff packing capacity dimensions.*

University of Texas, Arlington (4)

MATHEMATICS

Kelly, Theresa Diane, *Partical modelling of an elastic arch in three dimensions.*

Mahmoudi, Mohse, *Partical modelling of fluid phenomena in three dimensions.*

Sivapragasam, Sathananthan, *Some problems in impulsive integro-differential equations.*

Zouyousetain, Mohammad, *Difference equations of Volterra type.*

University of Texas, Austin (14)

MATHEMATICS

Blankenbaker, John R., *Fourier analysis on the Sierpinski gasket.*

Brahm, Matthew, *The Repovs conjecture.*

Burger, Edward B., *Diophantine approximation in S-integers.*

Chang, Yang Chun, *Chance constrained programming and Chebychev systems with applications.*

Hong, Chan Yong, *On some questions concerning weak identities, invariants, and integrality.*

Joubert, Wayne David, *Generalized conjugate gradient and Lanczos methods for the solution of nonsymmetric systems of linear equations.*

Kang, Joonsook Lee, *The condition number and the singularity of a certain interpolation matrix.*

Miyazaki, Katura, *Non-simple ribbon fibered knots.*

Oppe, Thomas Charles, *The iterative solution of large sparse linear systems using vector computers.*

Rong, Yongwu, *Degree one maps between geometric three-manifolds.*

Schumacher, Carol Smith, *Sequential domination in Banach spaces and the geometry of JH^*.*

Shi, Sheng Guang, *Accurate and efficient double-bootstrap methods.*

Struppeck, Thomas, *Inequalities for heights of algebraic subspaces with applications to construction of auxiliary polynomials.*

Sundheim, Paul, *The Reidemeister and Markov theorems via diagrams for links in 3-manifolds.*

University of Texas, Dallas (2)

MATHEMATICAL SCIENCES

Igwe, Jerome Okwuchukwu, *Some matrix identities and orderings applicable to combining multivariate estimates.*

Richardson, Paul Alton, *Construction of central,spin-orbit, and L-dependent potentials.*

UTAH

University of Utah (4)

MATHEMATICS

DeYoung, Gary Wayne, *The mathematical basis for phase response curves.*

Hernandez, Luis, *Maximal representations of surface groups in the group of isometries of a bounded symmetric domain.*

Jimenez-Reyes, Jesus, *The contraction problem for rational curves on complex varieties.*

Li, Ya, *The asymptotic behavior of solutions of nonlinear parabolic differential equations.*

Utah State University (1)

MATHEMATICS AND STATISTICS

Loveland, Susan Marie, *Spectral analysis of the Legendre equations.*

VIRGINIA

University of Virginia (3)

APPLIED MATHEMATICS

Cleary, Andrew James, *Algorithms for solving narrowly banded linear systems on parallel computers using direct methods.*

Harrar, David Lawrence, II, *Conjugate gradient methods for red/black systems on vector computers.*

MATHEMATICS

Thompson, Gary Lynn, *Subgroup rigidity in group rings.*

Virginia Polytechnic Institute and State University (9)

MATHEMATICS

Carpenter, Lonnie Eugene, *Cascade analysis and synthesis of transfer functions of infinite-dimensional linear systems.*

Hill, David Dean, *Finite dimensional approximations of distributed parameter control systems.*

Hymo, John Alexander, *Problems involving relative integral bases for quartic fields.*

Kang, Sungkwon, *A control problem for Burgers' equation.*

Liu, Zhuangyi, *Approximation and control of a thermoviscoelastic system.*

Rakowski, Marek, *Zero-pole interpolation of nonregular rational matrix functions.*

STATISTICS

Huang, Won-Chin, *Applications of the Chinese Remainder Theorem to the construction and analysis of confounding systems and randomized fractional replicates for mixed factorial experiments.*

Mercante, Donald, *Analysis of multispecies microcosm experiments.*

Ramsey, Philip J., *Estimation of group delay in the presence of short data records.*

WASHINGTON

University of Washington (13)

BIOSTATISTICS

Cologne, John B., *Nonparametric regression analysis of Ames mutagenicity assay.*

Drake, Christiana, *Inferring treatment effect from observational studies: Adjustment by prognostic variables vs. the propensity score.*

LeBlanc, Michael Leo, *Recursive partitioning for censored survival data.*

Murtaugh, Paul, *Simultaneous analysis of efficacy and toxicity in dose-ranging trials with new drugs.*

Sasieni, Peter, *Beyond the Cox model: Extensions of the model and alternative estimators.*

Sharples, Katrina, *Regression analysis of correlated binary data.*

Whitney, Coralyn, *Misclassification of covariates in logistic regression: An application for latent class analysis.*

MATHEMATICS

Bryan, Kurt Matthew, *On an inverse problem for certain discontinuous conductivities.*

Nelson, Gary S., *Congruences between periods of modular forms.*

Nielsen, Mark J., *Tilings of topological vector spaces.*

Richter, William G., *Attaching maps for the disk bundles of some Morse-Bott decompositions.*

STATISTICS

Geyer, Charles James, III, *Likelihood and exponential families.*

Michalak, John Charles, *Visualization of tree-based models.*

WISCONSIN

University of Wisconsin, Madison (30)

INDUSTRIAL ENGINEERING

Lai, Wenje, *A statistics-based information and expert system approach for activated sludge wastewater treatment process control.*

Leung, Ying Tat, *Single-run optimization of discrete-event simulations.*

MATHEMATICS

Felmer, Patricio Luis, *Applications of variational methods to Hamiltonian systems.*

Fischer, Ismor, *Discrete orthogonal polynomials.*

Huan, Zhongdan, *Generalized porous medium equations with force term.*

Kang, Hyeonbae, *Tangential Cauchy-Riemann equations on certain unbounded weakly pseudoconvex domains.*

Katzenberger, Gary Shon, *Solutions of a stochastic differential equation forced onto a manifold by a large drift.*

Kavanagh, James P., *Splittings of M-matrices.*

Mc Dougal, Kevin F., *Some combinatorial properties of $(0,1)$-matrices.*

Shader, Bryan L., *Biclique decompositions and tournaments.*

Welsh, Charles C., *Some results in crossed products and Lie algebra smash products.*

Zhang, Bingyu, *Some results for nonlinear dispersive wave equations with applications to control.*

STATISTICS

Carriere, Jacques, *Customer-focused decision making.*

Chen, Shun-Yi, *Tolerance limits for complex population.*

Chen, Zehua, *Interaction spline models.*

Chough, Keumhee Danielle, *Statistical issues in the repeated measures data in the presence of treatment effects.*

Gilardoni, Gustavo, *Combining prior opinions.*

Gu, Chong, *Computing smoothing spline models.*

Hau, Man Cheung, *Constrained experimental designs.*

Ho, Shu-Yen, *Sparse matrix methods for the unbalanced multifactor ANCOVA.*

Hsu, Shih-Jian John, *Bayesian inference and marginalization.*

Huang, Min-Ching, *Piecewise linear tree-structured regression.*

Kim, Choongrak, *A study on influential sets in regression.*

Kim, Honggie, *Contributions to correspondence analysis and contingency tables.*

Kramer, Timothy Talbot, *Process control from an economic point of view.*

Lee, Jooho, *On asymptotics for the NPMLE of the probability of discovering a new species and an adaptive rule for sequential searches.*

Ramirez, Jose Gregorio, *Sequential methods in statistical process monitoring.*

Robinson, James M., *Modeling inference and forecasting techiques for the analysis of non-life insurance claim reserves.*

Wang, Jung-Chao, *Orthogonal arrays and nearly orthogonal arrays with mixed levels: Construction and applications.*

Wei, Greg Cheng-Gang, *Posterial computations with applications for censored regression data.*

University of Wisconsin, Milwaukee (3)

MATHEMATICAL SCIENCES

King, Brian S., *Some properties of Cartesian squares of linearly-ordered continuous sets.*

Pattanaik, Lalit M., *Large sample properties of density estimators based on randomly right sensored data.*

Sivanesen, Sivalingam, *Iterates of maps on the interval.*

WYOMING

University of Wyoming (2)

STATISTICS

Evans, Marc A., *Topics in the estimation of population size from capture-recapture data using log-linear models.*

Morsi, Morsi Ali Fawzi, *Multivariate sampling models.*

CANADA

Dalhousie University (1)

MATHEMATICS, STATISTICS AND COMPUTING SCIENCE

Clack, Rolf, *Some Minkowski geometry and the isoperimetric problem.*

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The David II National Plan

By the end of the year, the Board on Mathematical Sciences will send to all 2000 mathematical sciences departments in the U.S. materials designed to aid them in using the David II Report to improve their resource bases and forge partnerships aimed at departmental improvement within their own institutions. This article describes this and related efforts for dissemination of the Report.

Last Spring, the Board on Mathematical Sciences (BMS) of the National Research Council issued the report, "Renewing U.S. Mathematics: A Plan for the 1990s," known as the David II Report. The report found that, despite gains in recent years, the resource base for mathematical sciences research has seriously eroded. The report also made recommendations to federal agencies, colleges and universities, and to the mathematical sciences community itself for renewal of the mathematical sciences enterprise. (Most of the report was reprinted in the past two issues of *Notices*.)

In order to insure that the report will have as widespread an effect as possible, the BMS is developing a multi-faceted plan for dissemination. The first step is distribution: the Board has printed 8000 copies of the report and 18,000 copies of the report's executive summary. Copies have been sent to all mathematical sciences departments, to university presidents, to officials in federal agencies and in Congress, to the science and education press, to leaders in industry and in state education and economic development departments. BMS has also conducted high-level briefings with federal agencies, (including DoD and NASA, as well as the Office of Science and Technology Policy and the National Security Agency) and will arrange for presentations before such academic groups as the American Association of State Colleges and Universities, the Association of American Universities, and the Association of American Colleges.

An important aspect of the dissemination plan focuses on outreach to the mathematical sciences community to give individuals the tools necessary to participate in the renewal of their profession. The centerpiece of the effort is *Actions for Renewing U.S. Mathematical Sciences Departments*, a document developed at a BMS workshop, held in June 1990, involving over two dozen chairs of mathematical sciences departments. *Actions* provides suggestions to departments for ways to use the David II report to argue for improved support for mathematical sciences within their own institutions. Intended as a sort of template for departmental improvement and renewal, the suggestions are flexible enough to be useful in a wide variety of institutions and departmental situations.

In approximately 25 well-referenced pages, *Actions* outlines steps in the renewal process and points to examples of successful programs in various institutions. Among the points covered in the document are:

- ***Departmental self-assessment.*** Specific questions are provided which can be used as a starting point for departmental discussions that can help pinpoint a department's strengths and weaknesses and explore its responsibilities and priorities.
- ***Suggestions for departmental improvements.*** Covering K-12, undergraduate, graduate, and postgraduate education, as well as disciplinary and interdisciplinary research, the document makes specific suggestions (with references to existing "success stories") that can help a department build on its strengths to better meet its institutional responsibilities. Departments are then better positioned to request the necessary resources.
- ***Reward system.*** When a department re-evaluates its mission, its reward system may need to change to reflect new faculty activities. Based on recommendations in the David II Report, suggestions are made for criteria (in addition to research) for evaluating those activities.

A preliminary version of *Actions* was distributed to attendees of the BMS Chairs' Colloquium, which was held in mid-October. Department chairs who did not attend the Colloquium should watch for *Actions*, which is to be mailed out along with other materials by the end of the year. Faculty members should be sure their chairs are aware of this effort and should keep abreast of developments within their departments.

Allyn Jackson
Staff Writer

Forum

The Forum section publishes short articles on issues that are of interest to the mathematical community. Articles should be between 1000 and 2500 words long. Readers are invited to submit articles for possible inclusion in Forum to:

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or electronically to notices@math.ams.com

Calculators, Computers and Mathematics Education: A Response to Edward Effros

Anthony Ralston
SUNY, Buffalo

Ed Effros's piece in the Forum ("Some Thoughts on 'Everybody Counts' ", *Notices*, May/June 1990) requires a response. Not because he is all wrong. But rather because so much of what he says is right that it may be too easy to believe that everything he says is right.

Let's start with where Effros is on target. Yes, the students he sees at UCLA and I see at Buffalo and most readers of the Forum see wherever they are have less understanding of mathematics than ever before. And it's getting worse. Yes also, some, perhaps many, certainly too many, of them cannot do simple calculations and have little facility with any symbol manipulations. And, yes, much of this is due to the inability of students to concentrate on anything, to the widespread passivity they exhibit, the major culprit in which must be TV. Yes, "low teacher salaries, low prestige, lack of support by society" etc. are much more important in our educational malaise than anything discussed in the National Research Council (NRC) and National Council of Teachers of Mathematics (NCTM) reports Effros castigates. (Failure of these reports to address these matters is fair criticism even though, given the constraints under which NRC committees work, it would have been very difficult for them to do so. I chaired the committee that drafted the report which was the basis of one of the NRC reports, "Reshaping School Mathematics". While the report which finally emerged from the NRC maw was a pale shadow of the report this committee wrote, the perspective on using calculators and computers in school mathematics which Effros deplores was retained faithfully from the committee report.)

Where does Effros go wrong? In the belief that those like myself who advocate much more calculator use in elementary school and much less pencil-and-paper arithmetic have caused the problems he sees or may exacerbate them. But:

- It cannot be that the college students Effros sees today have poor calculational skills because any mathematics class they attended caused them to become "hooked on their calculators"; almost no college freshman today saw calculators at all in their arithmetic classes in elementary school; indeed, there is almost no use of calculators even today in American elementary schools.
- More time is devoted to pencil-and-paper arithmetic in American elementary school classrooms than in those of any other developed country. In no other country by the end of eighth grade have most students seen virtually no mathematics except arithmetic. Basic pencil-and-paper arithmetic skill is almost the only area where American students do not do much more poorly than their counterparts in other countries.
- Numerous studies have suggested (no, not "shown") that, where calculators are used in the classroom, the result is not a diminution of pencil-and-paper skills.

So there is no way that Effros's students or any of yours have become "calculator idiots" through use of calculators in American classrooms. But could it perhaps be that these students have used calculators so consistently outside of the classroom that their elementary school calculational skills have atrophied to such an extent that they are, indeed, "calculator idiots" by the time they arrive in college? Maybe. But, if so, there is nothing, absolutely nothing you can do about it through more of the same old pencil-and-paper drill and practice that Effros advocates. Whatever we do in the classroom

and however we exhort the students, kids will use this technology whenever it is convenient.

What besides too much calculator use outside the classroom may have caused a loss of traditional calculational skill by the time students reach college? One possibility is that the continual emphasis on pencil-and-paper arithmetic skills through the first nine years of school (K-8) finally just turns too many kids off to mathematics in any form. Why now and not earlier when the readers of the Forum went to school? Because whereas when I went to school we could see parents and clerks etc. making use of these skills, **any** kid today must see that what he or she is being taught in school has no relevance whatever to the way things are done outside of school.

Here is the crux of the matter. Pencil-and-paper arithmetic skills have lost almost all their pragmatic value and will soon lose what little is left. Yet, as Effros believes and as virtually all mathematicians believe (certainly me included), "drill and practice remain the most important tools at our disposal for learning the first principles of mathematics". How can we retain the value of drill and practice without teaching skills which seem irrelevant to students? How can we prepare students to study further mathematics without turning far too high a percentage off to mathematics at the very beginning of their mathematical experience?

The essential answer is: Drill and practice need **not** mean **pencil-and-paper** drill and practice. A major challenge for mathematics educators is to devise appropriate drill and practice on calculators (arithmetic, graphic and symbolic) and on computers which will result in developing both the understanding to pursue further mathematics as well as the ability to do certain calculations mentally (e.g. simple arithmetic including some two-digit arithmetic, factoring simple quadratics). Effros is correct that without the ability to do such calculations instantly, there is no way students will be able to do the estimations which the NRC and NCTM reports emphasize.

Calculator and computer drill and practice will be very different from pencil-and-paper drill and practice. It will have to focus on the inductive paradigm: compute, conjecture and (at advanced levels) prove. It will involve students in doing many calculations with the purpose of developing insight about numerical and symbolic patterns. Can such calculator drill and practice be effective? I don't know and I don't think anyone else does either. But there is no a priori reason why it cannot be. You can be sure that, if the elementary school mathematics curriculum did not exist and we had to invent it, it would involve calculators from the very beginning of mathematics education. You can also be sure that, even if we overcome all the societal barriers to better education, mathematics education will continue to fail so long as calculators and computers do not become part of its warp and woof at all levels.

But, alas, those societal barriers are not about to be overcome in any foreseeable future. Thus, the disagreement between those who believe as Effros does and those who believe as I do may not matter much. But, at least, anyone interested in and involved with mathematics education should support research about and experimentation with the use of the new technology at all levels of mathematics instruction.

The Joy of TEX
Second Edition
A Gourmet Guide to Typesetting with the AMS-TEX macro package
M. D. SPIVAK, Ph.D.

This is the second edition of *The Joy of TEX*, the user-friendly guide to AMS-TEX, which is a software package based on the revolutionary computer typesetting language TEX. AMS-TEX was designed to simplify the typesetting of mathematical quantities, equations, and displays, and to format the output according to any of various preset style specifications. This second edition of *Joy* has been updated to reflect the changes introduced in Version 2.0 of the AMS-TEX macro package.

The first two parts of the manual, "Starters" and "Main Courses," teach the reader how to typeset the kind of text and mathematics one ordinarily encounters. "Sauces and Pickles," the third section, treats more exotic problems and includes a 60-page dictionary on special techniques. The manual also includes descriptions of conventions of mathematical typography to help the novice technical typist. Appendices list handy summaries of frequently used and more esoteric symbols.

This manual will prove useful for technical typists as well as scientists who prepare their own manuscripts. For the novice, exercises sprinkled generously throughout each chapter encourage the reader to sit down at a terminal and learn through experimentation.

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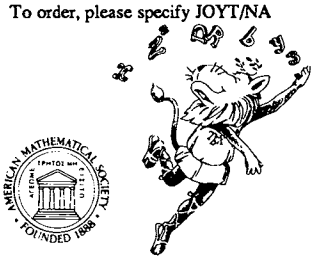

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Computers and Mathematics

Edited by Jon Barwise

This month's column

This month's column contains two articles. The first, by Wilfrid Kendall, has to do with computers and stochastic calculus. It is a very nice illustration of the way computers and mathematics can go hand in hand. The second article is a response to my editorial of last month. In that editorial I discussed problems in our research universities in keeping research and teaching in some sort of equilibrium and the role computers can play in solving the problem. In his article, Keith Devlin, chair of mathematics at Colby College, discusses the situation as he sees it in our liberal arts colleges. He discusses ways in which the computer can make four year colleges more attractive than in the past to mathematicians concerned about staying active in research. Both of these articles, in quite different ways, show the profound influence that computers can have on mathematicians and mathematics.

Submissions to this column should be sent to:

Jon Barwise
Department of Mathematics
Indiana University
Bloomington, IN 47405
email: barwise@iuvax.cs.indiana.edu
fax: 812-855-4678

Computer Algebra and Stochastic Calculus

*Wilfrid S. Kendall**

I first obtained regular access to a computer algebra system (*REDUCE***) about four years ago and was immediately fascinated by the direct way in which mathematical problems could be formulated within the package. In particular the mechanisms for establishing rewrite rules (LET rules in *REDUCE*) and substitutions clearly had a great deal to offer in probability theory and stochastic calculus. This article describes some work I did in following this up. First we set the scene with a rapid informal description of stochastic calculus.

The starting point is the Brownian motion or Wiener process B. This continuous-path random process can be characterized in many ways, reflecting its central importance. For our purposes a naïve approach is best: think of B as an infinitesimal random walk. Specifically, ΔB is random, independent of the past, and approximately equal to $\pm\sqrt{\Delta t}$ with probability $\frac{1}{2}$ each way. (In fact nonstandard analysis makes perfect sense of this point of view; see Anderson, 1976.)

The infinitesimal increment ΔB being of the order $\sqrt{\Delta t}$, it is not surprising to learn that with probability 1 the path of B has unbounded ordinary variation but has bounded *quadratic variation* (we find $\sum_0^t (\Delta B)^2 \to t$ when the limit is taken over, e.g., dyadic dissections of $[0, t]$). The unbounded ordinary variation means ordinary calculus cannot apply to B, so the integral $\int f\,dB$ has in general no conventional meaning. But the bounded quadratic variation allows development of a *stochastic* calculus for B, in which sense can be made of $\int f\,dB$ when (for example) f is continuous and $f(t)$ depends for each t only on the past values $\{B(s) : s \le t\}$. From this there follows the celebrated *Itô formula*: if F is a C^2 function then

$$F(B_t) = F(B_0) + \int_0^t F'(B)\,dB + \tfrac{1}{2}\int_0^t F''(B_s)\,ds. \quad (1)$$

*Wilfrid Kendall is lecturer in the Department of Statistics, University of Warwick, Coventry CV4 7AL, UK. His email address is w.s.kendall@cu.warwick.ac.uk. His research interests are in probability, its interface with differential geometry and partial differential equations, its applications to spatial statistics, and the effective implementation of stochastic calculus in computer algebra packages.

***REDUCE* is a reasonably-priced computer algebra package, available on a wide variety of mainframes, workstations, and well-configured personal computers (for example, 80386-based machines). It is broadly comparable to *Maple* and *Mathematica* as a *computer algebra* package, but lacks the numerical and graphical facilities of the other two. However there is a considerable quantity of contributed sub-packages, freely available and greatly enlarging the capabilities of *REDUCE*. Moreover *REDUCE* is distributed in source form, allowing easy modification – at least by experts! Supplier and other information, and information about the contributed software, is best available by electronic mail: in the first instance send the one-line message "help" to the network address reduce-netlib@rand.org or (if you are based in Europe) to reduce-netlib@can.nl.

Furthermore one can define random processes by requiring that they satisfy *stochastic differential equations* such as

$$Y_t = Y_0 + \int_0^t a(Y)\,dB + \int_0^t b(Y_s)\,ds. \qquad (2)$$

The solution Y exists and is unique when the coefficients a, b are Lipschitz and of linear growth.

A very rich theory of stochastic calculus has been built up from these elements over the last 40 years, finding all kinds of applications ranging from physics through chemistry and engineering to economics. In practical work one tends to use the shorthand notation of *stochastic differentials*. For example (2) is written as

$$dY = a(Y)\,dB + b(Y)\,dt \qquad (3)$$

and a general form of Itô's formula (1) then shows that for C^2 functions F the stochastic differential of $F(Y)$ is

$$dF(Y) = F'(Y)\,dY + \tfrac{1}{2}F''(Y)(dY)^2 \qquad (4)$$

using *Itô multiplication rules* such as $(dB)^2 = dt$, $(dB)(dt) = 0$, $(dt)^2 = 0$ to resolve occurrences of $(dY)^2$ into more conventional differentials. (For future use note that the Itô multiplication rule for stochastic differentials of two independent Brownian motions A and B is $(dA)(dB) = 0$.)

The theory extends beyond Brownian motion to *continuous semimartingales*. Loosely speaking these are random processes admitting 'noise plus signal' decompositions $X = M + V$ such that on the infinitesimal level M has future increment of zero mean $(\mathbb{E}[\Delta M \mid \text{past}] \approx 0)$ and V has future increment of approximately zero variance $(\mathbb{E}[\Delta V^2 \mid \text{past}] \approx 0)$. The statistical behavior of X may be specified by giving Itô multiplication rules for dM^2 (or in fact for dX^2) and other second-order products of stochastic differentials and by giving a formula for dV. Thus *second-order* and *first-order* structure of stochastic differentials determine the statistical structure.

This leads to a powerful and effective formalism for specification and investigation of continuous-path random processes. From basic random processes such as Brownian motions one builds others either as solutions of stochastic differential equations or as functions of these basic processes. Their behavior may then be investigated using the theory of stochastic calculus. However there are two practical problems, both arising from the second-order nature of (1) and its generalization (4).

The first problem is *how to interpret the stochastic differentials dY in an invariant sense?* By (1) and (4) it is clear that they are *second-order* quantities and not tensorially invariant. The geometrical notions of Riemannian metric and connection play a major part in resolving this problem. For example suppose the continuous-path random processes $X^1, \ldots, X^n$ are given by an autonomous set of stochastic differential equations

$$\left.\begin{aligned} dX^1 &= \textstyle\sum_{i=1}^n a_i^1(X)\,dB^i + b^1(X)\,dt \\ &\cdots \\ dX^n &= \textstyle\sum_{i=1}^n a_i^n(X)\,dB^i + b^n(X)\,dt \end{aligned}\right\} \qquad (5)$$

where $B^1, \ldots, B^n$ are independent Brownian motions. It is possible to give a succinct geometric description of X if the matrix $\underline{\underline{a}} = (a_i^j)$ is invertible. The inverse of the matrix $\left(\sum_{i=1}^n a_i^r a_i^s\right)_{r,s}$ endows n-space with a Riemannian metric, with respect to which $X = (X^1, \ldots, X^n)$ moves according to a *Riemannian Brownian motion with intrinsic drift vectorfield* $\underline{\tilde{\mathbf{b}}}$. That is to say on an infinitesimal scale ΔX can be thought of as follows: choose a point uniformly distributed on a (Riemannian metric) sphere of radius $\sqrt{\Delta t}$ centred at X, and set $X + \Delta X$ to be this point plus $\underline{\tilde{\mathbf{b}}}(X)\Delta t$. (Of course the drift vectorfield $\underline{\tilde{\mathbf{b}}}$ is computed using both $\underline{\underline{\mathbf{a}}}$ and $\underline{\mathbf{b}} = (b^j)$.)

The second problem is *the second-order nature of (1), (4) leads to involved computations.* Indeed the generalization of (4) applied to a function of n variables $X^1, \ldots, X^n$ leads to a sum of $\frac{n}{2}(n+1)$ terms, as opposed to n terms in ordinary calculus. Clearly computer algebra should have something to offer here.

The key to unlock the potential of computer algebra in stochastic calculus turns out to be the implementation in *REDUCE* of Itô's formula (4) and the language of stochastic differentials. For we may arrange for Itô's multiplication rules to hold using LET rules; for example

```
LET   dt**2  =  0,
      dt*dB  =  0,
      dB**2  =  dt;                    (6)
```

deals with the case of a Brownian differential dB. To implement Itô's formula (4) we establish a *REDUCE* procedure `d` such that `dy` expands the expression `y` to a second-order Taylor series in time using the language of differentials. This is done by formal differentiation of `y` with respect to time, setting the formal time derivative of `B` equal to `dB/dt`. It is then arranged within `d` that after simplification the Itô multiplication `LET` rules are applied, thus implementing the Itô formula. The point is that the essence of stochastic calculus is easily programmed into *REDUCE* by implementation of `d` and by specification of second-order structure for the stochastic differentials. The first-order or drift structure is also required and is specified by a list of substitutions (such as $dB \to 0$)

which are performed whenever it is required to find the drift of a stochastic differential. With this *symbolic Itô calculus* in place (and it takes only a page of *REDUCE* programming code) the scene is set to specify and to solve stochastic calculus problems in a language very directly related to the mathematical notation used by the theory.

Of course this implementation is proved effective only by it being useful in the solution of real problems. The principal application so far has been to the *diffusion of shape*. Consider three points A, B, C moving independently in Euclidean n-space according to Brownian motion (each coordinate being an independent Brownian motion). What do we mean by the shape of σ and what are the statistics of its movement? At least if $n \geq 3$ then shape is completely parametrized by the normalized squared side lengths $\sigma_A = BC^2/\sum BC^2$ et cetera. Symbolic Itô calculus allows the rapid derivation of the statistics of $\sigma_A, \sigma_B, \sigma_C$. It turns out that $\sigma = (\sigma_A, \sigma_B, \sigma_C)$ satisfies a set of stochastic differential equations which are autonomous once one makes a random time-change depending on the size measure $AB^2+BC^2+CA^2$ (this corresponds to the rather obvious observation that the shape of a Brownian triangle—whatever that may mean—will change faster when the vertices are closer together because then the Brownian movements will have greater effect). Now recall the relationship between autonomous stochastic differential equations and Riemannian geometry discussed after equation (5). This relationship involves somewhat complicated calculations, but these can be programmed into the *REDUCE* package once and for all as general-purpose procedures. When applied to the autonomous stochastic differential system for σ (in fact to a system for σ_A, σ_B using the relationship $\sigma_A+\sigma_B+\sigma_C = 1$) they yield the conclusion, *in its intrinsic Riemannian geometry the shape diffusion σ is Riemannian Brownian motion on a (northern) hemisphere of radius $\frac{1}{2}$ with an intrinsic drift directed to the north pole of strength $\frac{n-2}{2} \tan 2$ dist $(\sigma, \text{north pole})$*. (If $n = 2$ then the shape diffusion turns out to be Riemannian Brownian motion with zero intrinsic drift on the entire sphere of radius $\frac{1}{2}$.)

The fact that such a shape diffusion lives on a hemisphere (or sphere, when $n = 2$) was known before symbolic Itô calculus (D.G. Kendall; 1977, 1984), and the diffusion statistics for the cases $n = 2, 3$ were worked out by hand. The case of general n was first fully worked out using symbolic Itô calculus without recourse to automatic calculations of Riemannian geometry (W.S. Kendall, 1988) but now follows easily from application of the geometry procedures mentioned above. Symbolic Itô calculus has been further used successfully to evaluate the statistics of the yet more general case, the diffusion of shape of k points in n-space (W.S. Kendall, 1990). Here technical difficulties have to be solved connected with a requirement to deal with sums over symbolic ranges. (For completeness note that at about the same time as W.S. Kendall, 1990, other workers obtained similar or related results on k points in n-spaces without using computer algebra; see Bru, 1989, and Carne, 1990.)

More recent developments in symbolic Itô calculus include a facility for *automatic simulation*. We have noted that once second- and first-order statistics are specified for a semimartingale then its statistical behavior is determined (actually we also need its value at time zero). Consequently it is a routine matter to write procedures that use this information to construct simulations of the semimartingale. Thus on-line simulations are available via single-line commands in the course of computer-aided stochastic calculus.

There is also under development a set of procedures for analysis of systems of Itô stochastic differential equations. This uses recent results relating solution behavior to the structure of a Lie algebra determined by the system.

In all this a synergy is achieved: programming the structure of stochastic calculus into *REDUCE* exploits on the one hand 40 or more years' work on the theory of stochastic calculus and on the other hand the computational dexterity provided by computer algebra! The ultimate objective is to provide a whole suite of cooperating procedures that supply within a computer algebra package the means for computer-aided analysis and investigation of the processes of stochastic calculus.

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Computers and Research at Four-Year Colleges

*Keith Devlin**

The Package Tour

In last month's editorial, Jon Barwise considered the growing gap that separates the two faces of present day universities: teaching and research. He compared the situation to the distinction between a guided tour of old buildings (teaching) and the archeological discovery of new ones (research). He argued that there can be considerable tension between the guided-tour-face presented to students and parents and the archeological-dig-face projected towards industry and the research funding agencies.

A quite different situation prevails (or at least can prevail) at the four-year colleges, currently enjoying a somewhat better press than the large research universities. The size and structure of such institutions enables them to avoid a lot of the problems Barwise mentions and to provide what for many students (and many faculty) is probably the optimal path: the package tour, including a well-planned tour of the old buildings, with some time to clamber over the archeological dig as well.

I suspect it is no accident that a lot of the groundbreaking work in integrating the computer into the mathematics curriculum is being done not at the large universities but the small four-year undergraduate colleges such as my own. (Just take a look at the affiliations of past contributors to this column!) Such efforts are very time consuming, but bring comparatively little in the way of funding, and they are unlikely to turn the investigator into an academic superstar. But they represent the leading edge when it comes to finding new ways of attracting the next generation of mathematicians.

Research and the Four-Year College

The overall conclusion Barwise argues for is not that universities should turn their backs on research. Indeed, he asks for an honest declaration that research is their principal goal. Rather he wants them to increase their commitment to education while that research effort is maintained.

A parallel (dual?) argument can be made from the other side of the American higher educational scene: the four-year college.

Everyone knows that four-year colleges provide mathematical instruction to large numbers of students every year. But these days, thanks in large part to the computer, they are also playing an increasing role in the nation's research effort, and in this article I want to argue that this can only be to the good of their students.

I should say at the outset that what you are getting here is very much one person's first-impression, with all the advantages and disadvantages that accompany a fresh pair of eyes. Moreover, I am at one of the better known, highly selective small colleges that are able to attract an extremely good faculty. Until recently, I knew nothing about the U.S. small-college system. As an English mathematician who had worked in the British university system for the greater part of my twenty year career, I had spent considerable periods of time at a number of large research universities in the U.S.A. and Canada and various European countries but was largely unaware of the rest of the U.S. system. Unaware until the increasingly intolerable deterioration in my own university system forced me to consider a permanent move to the U.S.A. I spent the two years from 1987 to 1989 at Stanford as visiting faculty, and while I was there a number of colleagues advised me to look seriously at Colby College, which was at that time in the process of trying to find a new chair of their mathematics department.

I liked what I saw. Small classes of good students, a clear commitment to quality education, adequate resources, highly competitive salaries. Plus an attractive "family" atmosphere that one does not find at a larger institution.

In terms of my research career, there were only two possible negatives that I could see. One was the teaching load. At five semester-courses a year, this was a bit higher than at a research university, but the quality and small size of the classes easily offset this worry. Of more concern to me was the question of research isolation. And this, I assume, would be the question that looms uppermost in the minds of most young mathematicians starting out on their careers. Is it possible to maintain an active research program at a small college, especially one located away from the major centers?

A few years ago, I am sure the answer would have been "No." The high level of personal interaction most of us require in order to carry out mathematical research simply could not be maintained at a small college.

But things have changed and, as I mentioned above, the main factor that has brought about that change is the computer and, in particular, the availability of electronic mail and easy access to large-scale computer facilities. At Colby I am the only person working on mathematical

*Dr. Keith Devlin is the Carter Professor of Mathematics and Chair of the Mathematics Department at Colby College in Maine. He spent two years (1987–1989) as Visiting Associate Professor of Mathematics and Philosophy at Stanford University where he was involved in the research carried out at CSLI. He is currently writing a book about CSLI.

logic, but my research colleagues are always (in effect) just behind the screen of the terminal sitting on my desk. In fact, in some ways it is even better than having them just along the corridor. For one thing, there is no need to respond to each other immediately. If one of us is busy with other things or needs time to think or is maybe just plain tired, a response can be put off until later. For another thing, there is always a permanent record of what has been said. (Of course, as Richard Nixon demonstrated all too well, the telephone and tape-recorder combination also provides instant communications along with a permanent record. But it is an almost impossible medium over which to communicate science or mathematics.)

Though my own work does not require the use of supercomputers, they can be accessed from my desk, and are equally available to anyone whose work requires them.

All this makes physical location far less important than it once was. Proper consideration can also be given to family issues, such as living environment, housing costs, schooling, and the like. Suddenly, the small college in a pleasant, livable part of the country starts to look very attractive. And judging from the applicant pool for the three mathematics faculty vacancies we had at Colby last year, it looks very attractive to others too.

Life at a Small College

What is life like for the research mathematician at a small college? What do places like Colby look for in their faculty? In particular, what was I looking for as I set about hiring three new mathematics faculty members last year? First rate teachers, certainly. But they also had to be accomplished (or very promising) researchers. By and large, what their research consisted of did not matter. We are not in the research game in the way that places like Stanford and MIT and the large state universities are. We do not depend on huge amounts of outside research funding. We have no graduate courses, so we are not highly restricted as to the research interests of our faculty. Within certain limits, any good mathematician can teach most undergraduate courses. The inter-departmental struggles that Barwise alluded to in his article do not arise in an institution commited to a liberal arts education.

So professors at the better, small, private, four-year colleges find themselves with enormous freedom in their research. Interdisciplinary research of the kind that Barwise talks of, often so problematical at the large research universities, is positively welcomed at small colleges committed to a broad, multi-subject education, where departmental boundaries are often no boundary at all. (As we all know only too well, fighting for research facilities often sets department against department at a large school where research is paramount.)

Teaching Versus Research

So from the faculty member's point of view, the old idea that you go to a large research university to do research and a small college to teach is no longer valid, at least in mathematics. But what about the college's view of things? If its sole goal is teaching, why should a small, undergraduate college have any interest in research?

Oh dear, here comes that awful phrase again: teaching *versus* research. As if the two were somehow at odds with each other. Of course, they are not, and therein can be found the reason why small colleges need (and increasingly want) their faculty to be active in research.

Surely one of the things that a college education can provide that high schools in general cannot is to expose the student to the fact that mathematics is not just a cookbook of old recipes passed on from one generation to another, but a living, breathing, growing, and exciting subject. Indeed, a subject being actively pursued by that very professor who is standing in front of the class talking. Doing research should not detract from teaching. It should *enhance* it!

Four-year colleges such as my own are teaching establishments. No doubt about that. Their goal and pride is to provide a first rate, balanced education to a small (and often highly selected) group of bright students. So they look for faculty whose dedication to undergraduate teaching is total. That means faculty who like students, who enjoy working with them, and who are ready to put the needs of those students above their own research programs. That is the kind of individual attention that parents pay for when they send their offspring to a prestigious, small, private college.

But who are the people giving that dedicated, individual tuition? If I were paying for my son or daughter's private college education (and I shortly will be), I would want the professors to be active scholars, men and women truly involved in their subject, who could convey to their students a genuine love and enthusiasm for scholarship and for rolling back the frontiers of knowledge. I would not care exactly *what* the professor's research program was all about. Indeed, I might well not understand the first thing about it. But I would like to know that my Alice, John, or what have you, was being taught by a *real* academic, active in his or her own field and aware of the latest developments, one who exemplifies the fact that mathematics is not a spectator sport.

A Question of Degree

In the end it comes down to a question of degree: how much teaching and how much research? And here lies the root of the problem Barwise raised. When the pressure

on university faculty is overwhelmingly directed towards research, teaching can suffer and the student loses. Just as the student loses if the small-college professor does not have the intense relationship with the subject that is part and parcel of research.

The difference between the research university and the college should be not one of *all* research or *all* teaching, as is so often the case (or so it seems), but of *priorities*.

At a research university, research has (within limits) a priority over teaching when it comes to questions of hiring, promotion, and tenure decisions. There is nothing wrong with that. As Barwise notes, research is not something to be ashamed of, but rather is an important function, critical to the nation's survival.

At a four-year college, the priorities go the other way. But at both kinds of institution, both types of activity are important.

And both kinds of institution can provide the kind of computer-aided, undergraduate experience of mathematical discovery that Barwise thinks would be beneficial to today's mathematics students. Only two ingredients are required for that: dedicated faculty and adequate computing resources. Neither of these is the prerogative of any one type of institution. Indeed, by any reasonable measure, both are cheap these days. If anything, it is the small colleges that are currently leading the way in this kind of activity.

Small Colleges and the Research Game

To my newcomer's eye, the U.S. is in far better educational shape than it often appears to realize. Long ago in Europe, before the era of centralized research funding and grant applications (to say nothing of grant application consultants), scholars used to support their research activities by teaching the sons of the wealthy and the titled. They earned the freedom to pursue their own research exactly as they wanted, by presenting themselves as teaching scholars, not professional researchers. It was a system that produced vast amounts of first-rate and truly original research. And it probably did the students a lot of good as well.

By and large, Europe, and particularly my own Britain, is following a centralized path that removes the freedom to pursue original research programs. Perhaps more by accident than design, the U.S.A., with its diverse system stretching from large research universities to the small, liberal arts colleges, is now able to offer today's academics an individual freedom similar to that enjoyed by our European forefathers.

It will always be the case that some people need or prefer to work in a large research university, while others seek the deeper involvement with their students that only the small college can provide. An age of sophisticated electronic information networks can allow both groups to function together as a whole as far as research is concerned, and that surely can only be to the good of everyone, faculty, students, and society at large.

Things have changed a great deal for the research mathematician. We no longer work in communities; we work in networks. For the mathematician of yesteryear, getting into the right academic community was all important. Today the critical step is plugging in to the right network.

Mathematical Freeware and Shareware

In his book *Algorithmic Information Theory* (Cambridge University Press, 1987, 1988, 1990), Gregory Chaitin constructs a 200-page equation that shows that there is randomness in arithmetic. (For more information, see pages 984–987 of the October 1989 AMS *Notices*, or Chaitin's collection of his papers, *Information, Randomness & Incompleteness*, World Scientific, 1987, 1990.) This monster equation is mostly a LISP interpreter clothed in algebraic language, the LISP in question being a toy version of pure LISP invented by Chaitin expressly for this purpose. A great deal of software was involved in producing this LISP interpreter in the form of an equation. This software was originally written, mostly in assembly language, to run on an IBM mainframe. Chaitin has now rewritten everything in standard C and ported it to an IBM RISC System/6000 running AIX. Readers interested in obtaining this experimental software may contact him at chaitin@ibm.com, or write to him at IBM, P.O. Box 218, Yorktown Heights, NY 10598.

Inside the AMS

From Mathematical Reviews to MathSci

Taissa T. Kusma
Manager of Database Services

The following article describes the development of MathSci, the computerized and expanded versions of Mathematical Reviews, over the last decade and the role of the Database Services Department in its development, distribution, and user support.

Introduction

Mathematical Reviews (*MR*) has been in use since 1940. Its monthly issues are a key to the research literature for mathematicians around the world. Over 14,000 mathematicians also participate in its creation by writing evaluative or descriptive reviews for *MR*. Ten years ago *MR* was available in printed form only. Today there are several electronic versions in addition to print: a) **MathSci Disc.** The reviews of the last 10 years can be searched and browsed by using the 2 compact discs (CD-ROM) with a PC or a Macintosh. b) **MathSci Online.** Thirty years of *MR* with other subfiles can be accessed via terminal and telephone from almost anywhere in the world. c) **MathSci Tapes.** In some institutions MathSci is loaded on local mainframes for access by faculty and students.

The creation and production of *MR* is described in detail in two earlier issues of *Notices*: In December 1989 "From Published Paper to *MR* Review: How Does it Happen?", by Dr. Jane E. Kister, Associate Executive Editor of *MR*, and in February, 1990 "The Mathematical Reviews Database: The Power of Modern Technology", by Dr. William B. Woolf, Associate Executive Director of the AMS and former Managing Editor of *MR*. This article focuses on the electronic products developed from the *MR* database since 1980.

Literature Searching

Until 1982, finding a specific review or piece of information in *MR* required manual searching of several indexes and *MR* issues. For example, in order to prepare a 15-year bibliography of works by an author or on a given subject, one would need to search the following printed *MR* Indexes: the 1973-79 and the 1980-84 cumulative indexes and the annual indexes of 1985, 1986, 1987, 1988, and 1989. To include more current *MR* entries, the 1990 monthly issues would also have to be scanned. Once the relevant entries had been found and marked, each bibliographic reference had to be written, sorted, and typed. It seems incredible that gathering information was this time-consuming only a decade ago!

In 1982 searching for information in mathematics became enormously easier with the introduction of the computerized version of *MR*, called MATHFILE. Now the searcher could simply enter the name of an author or subject terms and, in seconds, the list of citations was ready to be displayed, downloaded or printed on command.

Online searching was not only a time-saver; the computer could also perform complex searches, almost impossible to do manually. Boolean operators 'AND', 'OR' and 'NOT' and features such as proximity operators allowed the searcher to combine concepts, search for phrases, and select or exclude records with any specified attributes.

MATHFILE - *MR* Online

An electronic version of *MR* became possible when the AMS changed to a computerized typesetting system, beginning with the July 1979 *MR* issue. The *MR* cumulative index for 1973-79 was also produced in machine-readable form. These *MR* files could be manipulated into different formats and used for electronic versions of *MR* information.

The Society decided to make the *MR* files available online through commercial vendors. At that time, databases in other disciplines (such as chemistry, biology, and psychology) were already online.

Preparations for 'Going Online' included negotiation of vendor contracts, design of the database format, writing of user documentation, and development of a marketing plan to promote the new service to its potential users. These ongoing tasks continue to be the basis for the Database Services Department (DS).

Vendor Contracts. Agreements were signed in 1981 with commercial vendors BRS* and DIALOG, with ESA-IRS (European Space Agency) in Italy in 1983, with the Japanese academic vendor NACSIS (National Center for Science Information System) in 1987, and with SilverPlatter (CD-ROM) in 1988. Financial terms and database file design were negotiated with each vendor. Other terms in the contract dealt with user/usage reports, correction of records, and other details.

Developing the Market. A marketing plan was prepared to promote the new product, MATHFILE, to its potential users - the librarians (intermediary searchers) and the mathematicians (end users). Promotion included the preparation of brochures and press releases and placement of ads in library journals. It was important to inform librarians/searchers about *MR* Online since the librarians, who perform searches on request, are often expected to decide which databases should be searched for the requested information. User-training workshops were arranged at various libraries, to explain MATHFILE coverage, structure of the file, and various features such as the use of the *MR* subject classification for searching.

Exhibits of MATHFILE were planned for both library and mathematics meetings. A test file of *MR* Online was shown at the AMS meeting in Cincinnati in January 1982 and in Toronto in August 1982. A comprehensive 200-page user guide was written and published by AMS before the release of MATHFILE. DS also worked with the vendors in the preparation of system-specific MATHFILE documentation. MATHFILE became available in October of 1982.

Database Design. MATHFILE was at that time a by-product of the printed *MR*. The *MR* data was keyboarded exclusively for the production of the printed publication; mathematical symbols, "mathematics", and other special characters were encoded with typesetting codes. There was no satisfactory way to reproduce mathematics on the computer for use by the online searcher.

The AMS considered several solutions to the mathematics problem in an online environment. The first option was to withhold the reviews and use only the bibliographic references. This solution was rejected since valuable in-depth searching of reviews would be impossible. Another option was to use the text of the reviews, but to strip out the mathematics, substituting "..." or "***" in place of the mathematical expressions. This was also rejected.

Finally, a decision was made to offer the complete reviews online and represent the mathematical symbols with descriptive mnemonics (even though they would appear strange to the eye of the mathematician). A program was developed at *MR* to remove all typesetting codes from the files and to change the encoded mathematics to mnemonics. It worked in most cases; however, certain complex expressions were not accurately represented. A better system was needed if our online database was to be fully transportable, mathematics and all.

TEX and Mathematics Online. The needed improvements came in 1985, when the AMS changed its typesetting to TEX, allowing faithful reproduction of the most complex expressions without loss of accuracy. By a happy coincidence, TEX implementations were developed for the PC and then for the Macintosh, and librarians/searchers began using PCs for searching online. It would now be possible to bring the reviews, with the mathematics, online!

Efforts began at the AMS to develop MathSciTEX software for "TEXing" *MR* online records on PCs. There was also an opportunity to bring MATHFILE users and TEX users together to see how the two interact.

TEX Library. Librarians, accounting for over 85% of online searching, were not familiar with TEX and turned to the AMS for help in obtaining the necessary software for MathSci. The AMS decided to become a distributor of TEX products for microcomputers (DOS machines and the Macintosh). The original goal was to provide one convenient source for all necessary pieces of TEX for MathSci users. However, the TEX Library at the AMS soon became a popular source of TEX products for many authors as well as for MathSci users.

The AMS does not carry all available TEX implementations, since their number is increasing and some are available in the public domain. In addition to commercial TEX products, the AMS distributes $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX and AMSFonts. These have recently become available via Internet on the AMS e-MATH system (see October 1990 *Notices*, page 1029). At the present time, users of MathSci on the DIALOG system can TEX records on DOS machines. Users of MathSci Disc can TEX records on PCs or the Mac; the necessary components for use with MathSci can be obtained from Database Services.

Expansion of MATHFILE into MathSci

In 1985 the AMS began to expand MATHFILE, containing *MR* 1973-85. The goal was to add more current material, older *MR* files, and to broaden the coverage of applied mathematics with additional indexes. In conjunction with this expansion, the name MATHFILE was changed to MathSci to reflect the broader coverage of the mathematical sciences.

*MathSci is no longer available via BRS. After the purchase of BRS by Maxwell Online, MathSci was discontinued in Sept. 1990 - the vendor is now focusing primarily on the biomedical market.

Current Mathematical Publications (*CMP*) was added as the Current Awareness subfile of MathSci. The tri-weekly *CMP* gives an advance listing of items to be reviewed in *MR* (or placed in the *MR* index). A search query of MathSci now retrieved both the *MR* records and the newly-published (and some not-yet-published) papers listed in *CMP*. To avoid duplicate records, *CMP* entries were deleted and replaced with the completed *MR* records as they became available.

Next, the *MR* 1959-72 bibliographic references were added to MathSci, increasing the *MR* subfile by 200,000 entries - a valuable addition for retrospective searching.

MATHFILE had proven itself as a time-saving research tool for mathematicians and researchers from other disciplines. In fact, we were surprised to learn (from the librarians/searchers) that many users of MathSci were not mathematicians, but researchers from fields such as computer science, statistics, engineering, and other related disciplines who needed information on applied mathematics. The usefulness of our online service could be enhanced by increasing the coverage in these applied areas. The AMS responded to market demands and decided to add applied material from other publishers.

CIS. We first approached the statisticians, publishers of the *Current Index to Statistics* (*CIS*). An annual printed bibliographic listing of the statistics literature, *CIS* contains applied material not covered in *MR*. The annual *CIS* is published jointly by the American Statistical Association (ASA) and the Institute of Mathematical Statistics (IMS) and is prepared by volunteer members of ASA/IMS. The annual index of approximately 10,000 records usually appears 6 months after the close of the year. By making *CIS* available in MathSci, the information would be available in timely updates and the comprehensive coverage of statistics would make MathSci useful. An agreement was signed with ASA/IMS and the *CIS* (from 1980 on) was added to MathSci as a separate *CIS* subfile.

TUKEY. The older literature of statistics, from 1902 to 1968, has been thoroughly covered in the 4-volume printed *Index to Statistics and Probability* by John W. Tukey and Ian C. Ross, published in 1968. The files (on an old tape) were purchased from publisher Jim Dolby, converted to MathSci format (with difficulty) and added to MathSci as the TUKEY subfile. This became the oldest segment of our database, covering the literature back to the beginning of the century.

ACM. Next we decided to augment the computer science coverage of MathSci. We began discussions with the Association for Computing Machinery (ACM) which publishes two secondary publications that would complement the *MR* coverage: the annual index *ACM Guide to Computing Literature* (*GCL*) and the monthly reviewing service *Computing Reviews* (*CR*). After two years of negotiations, an agreement was signed and we embarked on the project of converting the ACM files from four different typesetting formats to the MathSci format. This included the conversion of mathematics into TEX. To date, *CR* 1984-90 and *GCL* 1986-89 have been added to MathSci and work is being completed on data from 1981-1985.

Stanford Technical Reports (STR). A more recent addition to MathSci is the STR subfile, a listing of 30,000 technical reports in computer science, collected from various institutions by Stanford University Library. This is MathSci's only non-published literature subfile.

MathSci Disc - Compact Disc (CD-ROM)

MathSci Online is excellent for finding specific pieces of information from a very large volume of data. It can be very economical for the occasional user, since there is no up-front charge; although there is a usage fee. Mathematicians, however, were asking for a search system without usage charges; one they could use at leisure, on their own, without having to arrange the search through an intermediary searcher. Such a system came along in 1989 in the form of a compact disc–MathSci Disc.

The compact disc (CD-ROM) medium for storing and retrieving information is an ideal system where a high volume of usage is expected. A local self-contained system that can be used with either a DOS PC or a Macintosh, the CD-ROM has opened computerized searching to students and others who could not afford to search online. The only cost to the institution is an annual lease fee for the CD-ROM (with semiannual updates); all usage is free - much the same as a subscription to printed *MR*. Users need not worry about the clock ticking as they search. They may, however, have to consider others lining up to use the CD!

The AMS became the first scientific society to release its database on CD-ROM. The first issue of MathSci Disc was distributed in March 1989. It contained all the reviews from *MR* 1985-1988 and 70,000 *CMP* records on one 3.5 inch compact disc, with room left for updates. Subsequent updated CDs were produced in July and December 1989, the latter containing *MR* 1985-89 (plus *CMP*) and almost filling the CD.

In response to user requests, the AMS has recently expanded MathSci Disc to a two-CD system (rather than continuing with a one-CD system that contained only the most recent 5 years of *MR*). The *MR* 1981-86 records have been placed on one CD and *MR* 1987-June 1990 on the other "current" CD. *CMP* entries are present on both CDs. The "current" CD will be reissued in December with *MR* 1987-1990 records and *CMP* entries. The popularity of MathSci Disc is growing at a rate exceeding our expectations.

MathSci Tapes

The CD-ROM has become an extremely useful search tool in many libraries. Users love it - it is free and easy to use! It has raised in many an awareness of the existence of computerized searching. Yet, as more users discover the CD, some expect it to perform as a mainframe-based system: to be accessible from any terminal or computer, in the office or at home; to serve many users at the same time; and to search 50 years of abstracts from the complete MathSci database in one run.

As a result of these rising user expectations and the CD's limitations, a growing number of universities are setting up mainframe-based local search systems. Database tapes are loaded on the institution's mainframe computer, accessible to the whole campus. Such information retrieval systems, running on commercially available search software, combine the advantages of the CD-ROM (fixed annual lease, no usage fees, no telephone charges) with the advantages of the commercial online systems like DIALOG (large storage capacity, power of the computer, fast retrieval, and multiple user access from any location).

This new popularity of the old tape services, available before the advent of online, is due in large measure to the emergence of the CD-ROM products and the users' increasing appetite for information. The MathSci Tapes that are available include the complete online database, with all seven subfiles. MathSci Tapes are currently being loaded at two universities and several other institutions are considering MathSci Tapes for 1991.

Database Services Department

The DS department provides all marketing and support services for MathSci Online, MathSci Disc, and MathSci Tapes. Electronic products and services require a comprehensive marketing program and intensive user support, such as training, documentation, help line and other assistance. As changes and enhancements are made in the database, they are communicated to the users. Any questions or problems with searching are answered.

Electronic versions of journals are actually services rather than products: the user pays for the use of information and for the search system that finds and delivers the information. MathSci differs from a subscription to printed *MR* in that MathSci Disc (CD-ROM) is licensed for use on a 12-month basis (as are MathSci Tapes); updates are received for the duration of the lease. In case of cancellation, the CDs (or tape files) are returned to the AMS.

Marketing of electronic products/services is a more complex operation than is marketing of books and journals in print. Actual demonstrations of the database are necessary to convince potential users of its benefits and to expand its use. Instruction on using books and journals is not necessary, but users of databases do need to be shown how to use an electronic service. Thus the DS staff must be thoroughly familiar with the products and systems being marketed. There is much interaction between our MathSci users and DS staff. In fact, it is input from users that helps us develop enhancements as well as new services and products.

Editor's Note: An article describing the design and search capabilities of MathSci, including sample records of output, is planned for a future issue of Notices.

e-MATH addresses

As stated in the note in the October *Notices* (p. 1029), the Internet address for telnet access to the e-MATH machine is

`e-math.ams.com`

which is the machine's node name.

Some users may need to access the machine using its Internet Protocol (IP) number (rather than the node name); the IP number is

`130.44.1.100`

Users are urged to encourage their network managers to install domain name resolvers (which allow the use of node-name addresses). Use of IP number addresses is discouraged by Internet managers because it reduces flexibility in address changing. In particular, the above e-MATH IP number is subject to change.

News and Announcements

Mathematicians Receive MacArthur Awards

Two mathematicians were among the thirty-six MacArthur Fellows named in July 1990 by the John D. and Catherine T. MacArthur Foundation. DAVID KAZHDAN, professor of mathematics at Harvard University, will receive $275,000 over five years. NANCY KOPELL, professor of mathematics at Boston University, will receive a total of $290,000 over five years.

The MacArthur Fellowships, which range from $150,000 to $375,000 over five years based on the age of the recipient, have no strings attached. Individuals cannot apply for the fellowships. Instead, names are proposed to the Foundation by a group of more than 100 designated nominators in a variety of professions and areas of the country.

Dmitry-David Kazhdan was born on June 20, 1946. He received his Diploma in 1967 and his Kandidate Degree in 1969, both from Moscow State University. At that same institution, he held the position of researcher in the Laboratory of Mathematical Methods in Biology from 1969 to 1975, when he came to Harvard University as a visiting professor. He is currently professor of mathematics at Harvard.

Professor Kazhdan is known for his deep contributions to the fields of algebraic geometry, automorphic representations, differential geometry, differential equations, representations of finite groups, number theory and mathematical physics. Most of his work is in the theory of representations of groups, but he has also established results in ergodic theory, complex manifolds, and functional analysis. His recent interests have centered on the mathematics related to conformal field theory.

Nancy Kopell was born November 8, 1942 in New York City. She received her bachelor's degree in mathematics at Cornell University and her Ph.D. from the University of California at Berkeley, where she focused on dynamical systems. After holding a C. L. E. Moore Instructorship at the Massachusetts Institute of Technology (1967-1969), she became an assistant professor at Northeastern University and advanced to the rank of professor in 1978. In 1986, she moved to Boston University, where she is currently professor of mathematics. She has held visiting positions at a number of institutions, including the Centre National de la Recherche Scientifique (1970), the Massachusetts Institute of Technology (1975, 1976-1977), the California Institute of Technology (1976), and the Science Research Council in England (1976). She was a Sloan Fellow (1975-1977), an Invited Speaker at the AMS meeting in Philadelphia (1980), a University Lecturer at Northeastern (1980), an Invited Speaker at the International Congress of Mathematicians (1983), a Guggenheim Fellow (1984-1985), an R. Bowen Memorial Lecturer at Berkeley (1986), and a Plenary Speaker at two meetings of the Society for Industrial and Applied Mathematics, both in 1990.

Professor Kopell uses and develops methods of dynamical systems to attack problems of applied mathematics. She is especially interested in questions involving self-organization in physical and biological systems. With L. N. Howard, she has written a series of papers on pattern formation in oscillating chemical systems. Recently, with G. B. Ermentrout, she has been concerned with developing mathematics appropriate to analyzing neural networks that govern rhythmic motor activity, such as walking, swimming, and breathing. Such systems are, roughly, large collections of units, each of which is an oscillator or a close mathematical relative of an oscillator. The aim of the mathematics is to help sort out which properties of the units and their interactions have implications for the emergent properties of the networks. The techniques include extensions of invariant manifold theory, averaging theory, and geometric methods for singularly perturbed equations. The current work has led to the formation of a highly interactive group of physiologists and mathematicians, headed by Professor Kopell. In addition, she is also currently interested in geometric techniques in dynamical systems.

Foundation Makes Awards to Women Scholars

The Educational Foundation of the American Association of University Women (AAUW) has awarded fellowships and grants amounting to

more than $2 million to 101 women scholars. Among the awardees are three mathematicians.

TAMAR SCHLICK of New York University will receive a Postdoctoral Fellowship for her theoretical investigations into the structure, energetics and dynamics of supercoiled DNA. MARIA BROOKS, a statistician at the University of North Carolina at Chapel Hill, will recieve a Dissertation Fellowship for her research in bandwidth selection methods for kernel estimators of the intensity function of a non-homogeneous Poisson process. Also receiving a Dissertation Fellowship is TAMARA OLSON of New York University, whose research focuses on homogenization methods for coupled fields in composite materials.

Information on applying for fellowships from AAUW may be found in the October 1990 issue of *Notices*, page 1040.

Massey Named to Head NSF

Walter E. Massey has been named director of the National Science Foundation (NSF). Massey is professor of physics and Vice President of the University of Chicago for Research and for Argonne National Laboratory. He will replace Erich Bloch, who served at the NSF for a six-year term.

Massey's nomination to the NSF post has received widespread support in the scientific community. Many have pointed to his broad experience in academia, education, and administration as key assets. In addition, some have noted that because Massey is a highly-regarded black scientist, his serving in the NSF post is particularly timely, as the Foundation is intensifying efforts to attract more minority students into science, mathematics and engineering.

Until the end of the year, Massey is on sabbatical in France, where he is studying technology transfer. NSF Deputy Director Frederick Bernthal is currently acting director.

Massey received his bachelor's degree in physics in 1958 from Morehouse College in Atlanta. After completing his doctorate in physics at Washington University in 1966, he was a fellow and then a research physicist at Argonne until 1968. He was an assistant professor of physics at the University of Illinois at Urbana-Champaign from 1969 to 1970, when he moved to Brown University. He left Brown in 1979 to become director of Argonne and professor of physics at Chicago. He assumed his current position at Chicago in 1984.

Massey's research has centered on the many-body theories of quantum liquids and solids. Outside of research, he has been active on many advisory boards for scientific and educational affairs. Currently a member of the President's Council of Advisors on Science and Technology, Massey is a former member of the National Science Board, the policy-making body of the NSF. In addition, he is currently Vice President of the American Physical Society and former President of the American Association for the Advancement of Science.

News from the Institute for Mathematics and its Applications

University of Minnesota

The ongoing 1990-1991 academic year program at the Institute for Mathematics and its Applications (IMA) is Phase Transitions and Free Boundaries. The organizers are R. Fosdick, M.E. Gurtin, W.-M. Ni, and L.A. Peletier. The Advisory Committee is: H. Brezis, L.A. Caffarelli, D. Kinderlehrer, and J. Serrin. The aim of the program is to understand certain types of physical behavior which occur in phase transitions and in phenomena which involve free boundaries.

The first half of the year is concerned with phase transitions and is concentrating on equilibrium and dynamical problems involving two or more phases, with the transition region a sharp interface or a transition layer. This portion of the program (September-January) was discussed in the July/August 1990 issue of *Notices*. The second half of the program (February-June) will focus on free-boundary problems and on diffusion problems involving a singular mechanism, such as a degeneracy and free boundaries. Here the physical areas to be considered will include porous flow, jets, cavities, lubrication, combustion, plasma, coating flows, and the dispersal of biological populations.

During March 11-15, 1991 the IMA will present the Workshop Free Boundaries in Viscous Flows, organized by R. Brown, S. Davis, and S. Kistler. Viscous flows interact with liquid/fluid interfaces and solidification fronts in a wide variety of technologies including the processing of coatings, polymers, semiconductors single crystals and other advanced materials. This workshop will address the mathematical treatment of the dynamical and instability phenomena in such flows.

On April 15-19, 1991 the IMA will hold the Workshop Variational Problems, organized by A. Friedman and J. Spruck. One aim is to highlight new methods directions and problems in variational and free boundary theory. Some examples of topics include noncoercive variational and quasi-variational contact problems, free boundary problems with surface tension in non-variational form, new variational formulations and approximations to problems in plasma physics.The organizers hope also to concentrate on novel applications of variational methods to applied problems, that connect well to current mathematical theory. One such area of concentration will be on variational problems for the reconstruction and segmentation of images.

The Workshop Degenerate Diffusions will be held May 13-18, 1991. W.-M. Ni, L.A. Peletier and J.-L. Vazquez are the organizers. The emphasis in this workshop will be on

current and new problems in nonlinear diffusion equations involving free boundaries or sharp interfaces. The study of degenerate diffusion equations is actively pursued in many places. The objective of this workshop is to provide some focus in this endeavor, and by inviting scientists and engineers as well as mathematicians, to keep it firmly linked to concrete problems. The last two days of the workshop will be a celebration of J. Serrin's sixty-fifth birthday.

Finally, on May 30 and 31, 1991 the IMA in cooperation with the Center for Interfacial Engineering will host a special session on Polymer Configurations: Nonlinear and Nonlocal Diffusion Problems. This special session will constitute the first two days (and the more mathematical part) of the meeting Tethered Chains I: A Symposium on the Science of Polymer Surfactants, May 30-June 3. The June 1-3 program will be held in northern Minnesota. The organizers of the full program are F.S. Bates, T.P. Lodge and M. Tirrell. Tethered chains refers to polymer chains that are attached to surfaces or grafted on to structures by their ends. The symposium will cover theoretical experimental and computer simulation work on the configurations and manifestations of the signature behavior of tethered chains. The mathematical theory of tehtered chains is currently founded on the analysis of self-consistent field equations of the Schrödinger or biased diffusion type equations, leading to a variety of nonlinear and nonlocal diffusion problems.

The IMA Postdoctorates in Industrial Mathematics program is now underway with four new postdocs in residence. These appointments are in addition to the regular IMA postdoctoral program and are funded jointly by the NSF and by Honeywell, Inc. and 3M. They are designed to prepare mathematicians for research careers involving industrial interaction. Postdoctorates spend 50% effort working with a team of scientists from one of the sponsoring industries and 50% effort in the regular IMA program. Applications for the 1991-1992 program year are due January 15, 1991.

For more details concerning any of these programs, see the Stipends section of the October issue of *Notices* and the Meetings and Conferences section of this issue.

News from the Mathematical Sciences Institute

Cornell University

The many aspects of partial differential equations are being explored in a special program of invited lectures at the Mathematical Sciences Institute (MSI). This fall we have already heard from P. Constantin (Univ. of Chicago) on PDE's and Fluid Mechanics, from A. Eden (Arizona State Univ.) on Exponential Attractors for Navier-Stokes Equations and from G. Ponce (Pennsylvania State Univ.) on Dispersive Equations. J.-C. Saut (Univ. Paris-XII and Paris Sud) will speak on Linear and Nonlinear Dispersive Waves in March and April 1991, and C. I. Foias (Indiana Univ.) will discuss Navier-Stokes Equations during the summer of 1991. Other visits are being planned. For further information, please contact P. Holmes or E.S. Titi at the address below.

In addition, a workshop on the Mathematics of Computation in Partial Differential Equations will celebrate the 60th birthday of J.H. Bramble. Organized by L. Wahlbin, R. Falk, V. Thomée and A. Schatz, this workshop will be held January 25–27, 1991. A broad range of topics related to the mathematical theory of numerical methods for partial differential equations will be discussed. For information, contact L. Wahlbin or A. Schatz at the MSI; 607-255-4013; wahlbin@mssun7.msi.cornell.edu or schatz@mssun7.msi.cornell.edu.

MSI is accepting applications for the position of postdoctoral visitor for the academic year beginning August 1991. MSI will offer appointments for research in nonlinear analysis, stochastic analysis and symbolic methods in algorithmic mathematics. For complete information, consult the announcement elsewhere in this issue of *Notices* or contact W.V. Kone, Associate Director, at the address below.

The MSI recently moved into a new and expanded headquarters. To attend a workshop or for information on MSI activities, contact the MSI at their new address: Suite 321, 409 College Avenue, Ithaca, NY 14850-4697; 607-255-8005; Fax: 607-255-9003.

Argonne Program for Mathematics Education

Argonne National Laboratory will establish a mathematics visualizaton laboratory at Chicago State University, as part of a new computer-based educational project to improve mathematics teaching in Chicago-area schools. The project, called A-PRIME, is based on *Mathematica* software and is designed to strengthen teachers' understanding of mathematical principles.

Argonne computer scientists will work with Chicago State faculty to develop computer files called "notebooks" and classroom materials that illustrate mathematical concepts. Notebooks can be run interactively, allowing users to choose topics, enter details of problems and receive numerical and pictorial results.

Other goals of A-PRIME include developing a college curriculum to train future teachers more effectively in mathematics and science, creating a training program for in-service teachers based on computer visualization techniques and developing graphics tools for future classrooms.

Funding Information for the Mathematical Sciences

Research Opportunities for Women

The National Science Foundation (NSF) sponsors a number of activities to provide support for women researchers in all science and engineering disciplines. As a participant in these efforts, the NSF's Division of Mathematical Sciences (DMS) encourages women mathematicians to apply to the Research Opportunities for Women (ROW) program.

Three kinds of awards are available through ROW. *Research Planning Grants* are for women who have not previously served as principal or co-principal investigators on individual federal research awards or whose research career has been interrupted for at least two of the last five years. These grants provide limited support to facilitate preliminary studies and other activities related to a research project. The maximum grant available is $18,000. *Career Advancement Awards* assist in developing the careers of women researchers. These awards are intended for women who have an established research career in their current field or in a new one. Women who have had previous research support are eligible for the program, but this is not required. The maximum grant available is $50,000.

At the time of this writing, the eligibility requirements for these two grants were under discussion at the NSF. Those interested in applying should consult a copy of the current program announcement or discuss the new requirements with NSF staff. In addition, a final decision on a deadline had not been made, but NSF staff said it would most likely be **January 15, 1991**.

Proposals for the Research Planning Grants and the Career Advancement Awards are handled differently from regular research grants, as they are reviewed by a panel rather than through mail review. The panel assessment assures that these proposals compete only among themselves. The format for proposals also differs considerably from that for regular research grants, so it may be wise to consult with DMS staff before applying. Funds are limited, but the DMS would nonetheless like to encourage more qualified women to apply.

The third category of awards is *Research Initiation Awards*, which are one-time grants designed to provide opportunities to women to become actively engaged in research as independent investigators. Like the planning grants, these awards are open to those women scientists, mathematicians, and engineers who have not been principal or co-principal investigators on research grants before. The procedure for applying for the Research Initiation Award is the same as for a regular research grant; checking a box on the proposal cover sheet indicates that the proposal should be considered for funding under the ROW program. As with all research proposals submitted to the DMS, there is no deadline, but it's best to get them in soon after the start of the fiscal year (**October 1**).

Peter W. Arzberger, the DMS program officer in charge of the ROW program, would be happy to provide program announcements and more information. He can be reached at: Division of Mathematical Sciences, Room 339, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; telephone 202-357-3693; email parzberger@nsf.gov on Internet (or use @nsf.arpa for CSNET and @nsf for Bitnet).

Call for Proposals for Calculus Renewal

The National Science Foundation (NSF) has for the past three years sponsored a program to support projects aimed at improving the teaching of calculus at the collegiate level. Designed to stimulate the development of high-quality calculus curricula, the program is managed by the Division of Undergraduate Science, Engineering, and Mathematics Education with the cooperation of the Division of Mathematical Sciences.

Computer technology, more realistic applications, development of mathematical intuition, laboratory experiences, increased student involvement in the learning process, and concepts rather than manipulation of formulas—these are some of the emphases of the projects funded in this program. The program has also sponsored several workshops, provided start-up funding for the *UME TRENDS* newsletter on undergraduate mathematics education reform, and supported a project to disseminate descriptions and summaries of a host of calculus reform projects. (For a list of the proposals most recently

funded, see the October 1990 issue of *UME Trends*.)

For the upcoming round of proposals, there will be a new emphasis on "Adaptation, Refinement, and Implementation Projects." Proposals funded under this category may be regional or local in nature and will adapt, refine, and implement new approaches to calculus instruction that have already been developed and tested, at least on a small scale. The approaches adapted in these projects need not have been supported by the NSF. The projects will involve substantial portions of the calculus students and of the faculty who normally teach calculus. Information about new approaches to calculus may be found in a report of the Mathematical Association of America (MAA) entitled "Priming the Calculus Pump: Innovations and Resources." (The report is available for $20 from the MAA, 1529 Eighteenth Street, NW, Washington, DC 20036.)

In addition, the NSF calculus program will continue to fund promising curriculum development projects that focus on topics typically covered in the first two years of calculus. Currently, the program supports several pilot projects dealing with the differential equations and linear algebra topics typically part of two-year calculus sequences; it is expected that proposals will now be received for curriculum development in those areas. Proposals that contain features similar to those being addressed by other projects should explain how the proposed project improves upon or is significantly different from the existing projects.

The closing date for proposals is **February 8, 1991**. The program announcement and more information are available from John S. Bradley, USEME Room 639, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; telephone 202-357-7051; electronic mail jbradley@note.nsf.gov (Internet) or jbradley@nsf (Bitnet).

Proposals Sought for IUTAM Symposia

The United States National Committee for Theoretical and Applied Mechanics (USNC/TAM) seeks proposals from U.S. researchers for Symposia to be held under the auspices of the IUTAM (International Union of Theoretical and Applied Mechanics). The Symposia may be held anytime during the calendar years 1994-1995.

The aim of an IUTAM Symposium is to assemble a group of active scientists from a well-defined field of research. In order to insure effective communication, the number of participants is limited to approximately sixty, and participation is by invitation only.

After a competitive screening of proposals, the USNC/TAM will forward to IUTAM a maximum of five for the two year period. Those proposals will then compete against proposals from other countries. Final decisions will be made at the meeting of the General Assembly of IUTAM at the International Congress, to be held in Haifa, Israel, in August 1992 (see the announcement in the Meetings and Conferences section in this issue of *Notices*). From twelve to twenty Symposia will be scheduled for 1994-1995.

For each proposal selected, IUTAM will appoint a Scientific Committee, the chair of which will normally be the individual submitting the original proposal. Invitations to attend a Symposium are made by the Scientific Committee solely on the basis of scientific merit. A proposer may indicate a preference for holding his or her symposium in 1994 or 1995, but the final decision on scheduling will be worked out jointly by the Scientific Committee and IUTAM.

IUTAM provides a small amount of financial support to pay some travel expenses, primarily for young scientists and scientists from developing countries. Organizers of symposia are encouraged to seek additional financial support from other sources.

Proposals to host symposia should be submitted on a prepared application form. A Symposium-Invitation Kit, consisting of the application form, some examples of previously approved applications, and a list of recent symposia, may be obtained upon request from: Professor Philip G. Hodge, Jr., Secretary, USNC/TAM, 107 Akerman Hall, University of Minnesota, Minneapolis, MN 55455; telephone 612-625-3444 or 612-625-8000; electronic mail: pghodge@vx.acs.umn.edu or pghodge@umnacvx.bitnet. Applications should be sent to the Secretary no later than **November 15, 1991**.

1991 AMS Elections

Nominations by Petition

Vice-President or Member-at-Large

One position of vice-president and member of the Council ex officio for a term of two years is to be filled in the election of 1991. The Council intends to nominate at least two candidates, among whom may be candidates nominated by petition as described in the rules and procedures.

Five positions of member-at-large of the Council for a term of three years are to be filled in the same election. The Council intends to nominate at least ten candidates, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

Petitions are presented to the Council, which, according to Section 2 of Article VII of the bylaws, makes the nominations. The Council of 23 January 1979 stated the intent of the Council of nominating all persons on whose behalf there were valid petitions.

Prior to presentation to the Council, petitions in support of a candidate for the position of vice-president or of member-at-large of the Council must have at least 50 valid signatures and must conform to several rules and operational considerations, which are described below.

Editorial Boards Committee

Two places on the Editorial Boards Committee will be filled by election. There will be four continuing members of the Editorial Boards Committee.

The new members will be elected in a preferential ballot. The President will name at least four candidates for these two places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Nominating Committee

Three places on the Nominating Committee will be filled by election. There will be six continuing members of the Nominating Committee.

The new members will be elected in a preferential ballot. The President will name at least six candidates for these three places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Rules and Procedures

Use separate copies of the form for each candidate for vice-president, member-at-large, or member of the Nominating and Editorial Boards Committees.

1. To be considered, petitions must be addressed to Robert M. Fossum, Secretary, P.O. Box 6248, Providence, Rhode Island 02940, and must arrive by 28 February 1991.

2. The name of the candidate must be given as it appears in the *Combined Membership List*. If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of the *Notices*. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate's mailing label or the Providence office.

3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.

4. On the next page is a sample form for petitions. Copies may be obtained from the Secretary; however, petitioners may make and use photocopies or reasonable facsimiles.

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the *Combined Membership List* and the mailing lists. No attempt will be made to match variants of names with the form of name in the CML. A name neither in the CML nor on the mailing lists is not that of a member. (Example: The name Robert M. Fossum is that of a member. The name R. Fossum appears not to be.)

7. When a petition meeting these various requirements appears, the Secretary will ask the candidate whether he is willing to have his name on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving his consent.

NOMINATION PETITION FOR 1991 ELECTION

The undersigned members of the American Mathematical Society propose the name of

_____

as a candidate for the position of (check one):

- ☐ **Vice-President**
- ☐ **Member-at-Large of the Council**
- ☐ **Member of the Nominating Committee**
- ☐ **Member of the Editorial Boards Committee**

of the American Mathematical Society for a term beginning 1 January, 1992.

Name and Address (printed or typed)	Signature
	Signature
	Signature
	Signature
	Signature
	Signature
	Signature

CALL FOR SUGGESTIONS

There will be a number of contested seats in the 1991 AMS elections.
Your suggestions are wanted by

THE NOMINATING COMMITTEE
for president-elect, vice-president, trustee, and five members-at-large of the council
and by

THE PRESIDENT
for three Nominating Committee members and two Editorial Boards Committee members

In Addition

THE EDITORIAL BOARDS COMMITTEE
requests suggestions for appointments to various editorial boards of Society publications.

Send your suggestions for any of the above to:

Robert M. Fossum, Secretary
American Mathematical Society
Department of Mathematics
University of Illinois
1409 West Green Street
Urbana, IL 61801

San Francisco Meetings
January 16–19, 1991

Supplement to Announcement in October Notices

Please refer to the Preliminary Announcement for this meeting which appears on pages 1083–1127 of the October 1990 issue of *Notices*. The Important Deadlines from the preliminary announcement are reproduced below for convenience. The forms for Preregistration/Housing, MAA Minicourses, and the Mathematical Sciences Employment Register are located at the back of this issue.

AMS-AWM-MAA Invited Address

The correct spelling of the name of this speaker is CHRISTEL ROTTHAUS.

AMS Retiring Presidential Address

The Retiring Presidential Address by G.D. MOSTOW has been rescheduled for Wednesday at 9:00 a.m. It was originally scheduled for Saturday.

AMS Committee on Science Policy

The AMS Committee on Science Policy government speaker on Friday at 10:05 a.m. is TIMOTHY O. O'MEARA, Provost, University of Notre Dame.

IMPORTANT DEADLINES

AMS Abstracts	
For Consideration for Special Sessions	**September 19**
Of Contributed Papers	**October 10**
MAA Abstracts	
Of Contributed Papers	**September 25**
Employment Register	
(Applicants & Employers)	**November 16**
EARLY Preregistration and Housing	**November 9**
ORDINARY Preregistration and Housing	**November 16**
MAA Minicourse Preregistration	**November 16**
FINAL Preregistration	**December 17**
Motions for AMS Business Meeting	**December 10**
Housing Changes/Cancellations with Housing Bureau	**December 12**
Preregistration Cancellations (50% refund)	**January 11**
Employment Register Cancellations (50% refund)	**January 11**
AMS Banquet (50% refund)	**January 2**
AWM Banquet (50% refund)	**January 2**
MER Banquet (50% refund)	**January 2**
NAM Banquet (50% refund)	**January 2**

Other AMS-MAA Sessions

The title of the session on estate planning has been changed to *Estate planning for the mathematical community.*

Other MAA Sessions

MARIA A. REID, Borough of Manhattan Community College, has organized a session of contributed papers titled *Hands-on strategies in teaching college mathematics.* This session is sponsored by the Committee on Opportunities in Mathematics for Underrepresented Minorities. The speakers are HUMBERTO CANATE, Hostos Community College, CUNY; ROBERT GYLES, Community School District 4, New York; CLAUDETTE BRADLEY, University of Alaska at Fairbanks, and ED DUBINSKY, Purdue University. The session will be scheduled on Wednesday or Thursday.

The CAS Workshop Reunion is now scheduled to begin at 6:30 p.m. on Wednesday evening instead of 7:00 p.m.

The student workshop on Thursday afternoon will be given by MARILYN DURKIN, Bentley College. The title of the workshop is *Chaos, fractals, and dynamics–Computer experiments in mathematics.*

The title of the special lecture by LESTER LANGE on Friday evening is *Desirable scientific habits of mind learned from George Pólya.*

Speakers and titles for the CCIME Panel Discussion on Thursday at 2:15 p.m. are DONNA BEERS, Simmons College, *Calculus laboratories and cooperative learning*; ERIC MULLER, Brock University, *Using MAPLE in a large service calculus course*; ANITA SOLOW, Grinnell College, *Writing materials for calculus labs.*

An updated list of panelists for the MAA-NCTM Panel Discussion on Saturday includes BERNADETTE H. PERHAM, Ball State University; STEPHEN B. MAURER, Swarthmore College; and TIMOTHY V. CRAINE, Trinity College.

Further information about the Women and Mathematics (WAM) session on Friday morning follows: This program commemorates 15 years of service with a panel discussion highlighting its past and present activities and

hopes for the future. EILEEN L. POIANI was the first director of the program, serving from 1975 to 1981. She remains actively involved with WAM today as an advisor. MARY HESSELGRAVE has been coordinator of the New York/New Jersey region since 1982, one of the three original regions. VIRGINIA KNIGHT, who is relatively new to the program, recognized the need for a WAM region in North Carolina in 1988, organized participants, obtained funds, and now has a very active and growing region. ROSEANNA TORRETTO was one of the first participants of the WAM program, recruited by Jean Pedersen in 1975 for the Northern California region; she remains active in the program today. ALICE KELLY, the moderator, is the current director of WAM and has been an active member since its inception in 1975. Each panelist will discuss her involvement in the program from her unique perspective. There will be time for questions from the audience and suggestions for WAM's future activities.

On Thursday from 9:00 a.m. to 10:55 a.m. a session titled *Intervention projects for minority students* will be held. This session is being organized by WILLIAM A. HAWKINS, Director of Strengthening Underrepresented Minorities Mathematics Achievement (SUMMA). Presenters include ARDEL BOES, Colorado School of Mines, and CLAUDETTE BRADLEY, University of Alaska at Fairbanks; LLYOD GAVIN, California State University at Sacramento; and MANUEL BERRIOZABAL, University of Texas at San Antonio.

The correct affiliation of the moderator of the CUPM Subcommittee on Quantitative Literacy Debate, Linda R. Sons, is Northern Illinois University.

Activities of Other Organizations

The tentative schedule for the **Association for Women in Mathematics** (AWM) Symposium on Wednesday, January 16, follows:

CAROLYN DEAN, University of Michigan, Ann Arbor, title to be announced, 8:00 a.m.; BERNADETTE PERRIN-RIOU, University of Paris, *P-adic representations and L functions*, 8:30 a.m.; MEI-CHI SHAW, University of Notre Dame, *Solvability and regularity for tangential Cauchy-Reimann operators*, 9:00 a.m.; JIANG-HUA LU, Massachusetts Institute of Technology, *A symplectic proof of a classical convexity result on complex matrices*, 9:30 a.m.; RUTH J. WILLIAMS, University of California, San Diego, *Reflecting Brownian motions in polyhedral domains*, 10:00 a.m.; LAURETTE TUCKERMAN, University of Texas at Austin, *Bifurcations and symmetry-breaking in computational fluid dynamics*, 10:30 a.m.; LYNNE M. BUTLER, Princeton University, *Combinatorics and topology of subgroup complexes*, 3:20 p.m.; SHAFI GOLDWASSER, Massachusetts Institute of Technology, title to be announced, 3:50 p.m.; ELISE CAWLEY, SUNY at Stony Brook, *Gibbs measures and deformations of toral diffeomorphisms*, 4:20 p.m.; JILL PIPHER, Brown University, *Higher order elliptic partial differential operators in non-smooth domains*, 4:50 p.m.

The title of the AWM Emmy Noether lecture by ALEXANDRA BELLOW is *Almost everywhere convergence: The case for the ergodic viewpoint.*

The AWM Open Reception has been moved from Wednesday evening to 9:30 p.m. on Thursday evening.

Further information on the **Association of Research Libraries** (ARL) session on Friday evening follows:

ANN OKERSON, Association of Research Libraries Office of Scientific & Academic Publishing, will give an overview of the sweeping changes occurring in scholarly publishing and communication, with the attendant effects on library budgets, library services, and implications for the academic community. NANCY ANDERSON, Mathematics Librarian, University of Illinois, will speak on a mathematical sciences librarian's view of the information "crisis" and its implications for collections and services to mathematicians in a research library setting. Emerging electronic projects to be one focus of this presentation. A view of an AMS editor about meeting needs of mathematics scholars; the Society's role in utilization of new technologies, creation of new products or enhancements of existing products will be given by GERALD JANUSZ, Executive Editor, *Mathematical Reviews.* A mathematician's view and response will be given by RICHARD A. ASKEY, University of Wisconsin, Madison. Remaining time will be for questions and discussions.

The **Joint Policy Board for Mathematics** and the **Office of Governmental and Public Affairs** (JPBM/OGPA) will hold its annual science policy session on Thursday, January 17. The speaker will be a distinguished federal policymaker with significant responsibility for mathematics research and education policy. The session will begin with a reception at 6:15 p.m. The address and discussion will begin at 7:00 p.m.

Hotel Accommodations

Please note that the San Francisco Hilton on Hilton Square is offering a limited number of rooms at a special student/unemployed rate. Persons requesting these rooms on the Preregistration/Housing Form (found at the back of this issue) are thereby certifying that they meet the definition of student or unemployed as it appears on the front of the Preregistration/Housing Form, and should be prepared to sign a statement to this effect if so requested.

Miscellaneous Information

San Francisco is on Pacific STANDARD Time in January.

The Parent-Child Lounge will be furnished with casual furniture, crib, a changing area, some assorted toys, and a VCR and monitor. A television set will no be available as previously announced.

Invited Speakers and Special Sessions

Invited Speakers 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.

San Francisco, CA, January 1991

Please refer to the first announcement of this meeting which begins on page 1083 of the October *Notices*.

South Bend, IN, March 1991

Leonid G. Makar-Limanov
Donald G. Saari
Stephen D. Smith
Deane Yang

Tampa, FL, March 1991

Josefina Alvarez
Ronald A. DeVore
Michel L. Lapidus
Donald St. P. Richards

Orono, ME, August 1991

H. W. Lenstra (Progress in Mathematics Lecture)
Richard M. Schoen (Progress in Mathematics Lecture)

Fargo, ND, October 1991

Ian D. Macdonald
Harald Upmeier
Henry C. Wente
Sylvia M. Wiegand

Baltimore, MD, January 1992

Michael E. Fisher (Gibbs Lecture)

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 the relevant information to the Associate Secretary for the Section who will forward it to the Section Program Committee.

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 *Notices* went to the printer. The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

January 1991 Meeting in San Francisco, California

Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: Expired

Please refer to the first announcement of this meeting which begins on page 1083 of the October *Notices*.

March 1991 Meeting in South Bend, Indiana

Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: December 13, 1990

Charalambos D. Aliprantis and Carl P. Simon, *Mathematical economics and dynamical systems*
Jonathan L. Alperin and Stephen D. Smith, *Simplicial complexes associated to finite groups and their representations*
Steven A. Buechler, *Model theory*
Frank X. Connolly, *Geometric topology*
William G. Dwyer and Anthony D. Elmendorf, *Algebraic topology*
Gail R. Letzter, Peter Malcolmson and Frank Okoh, *Noncommutative ring theory*
John E. McCarthy, *Hilbert spaces of analytic functions*
Mohsen Pourahmadi, *Probability and prediction theory*

March 1991 Meeting in Tampa, Florida

Southeastern Section
Associate Secretary: Joseph A. Cima
Deadline for organizers: Expired
Deadline for consideration: December 13, 1990

Josefina Alvarez, *Harmonic analysis and applications*
Ronald A. DeVore, Edward B. Saff and B. Shektman, *Approximation theory*

David A. Drake, Chat Yin Ho and Geoffrey R. Robinson, *Finite groups and related topics*
Paul E. Ehrlich and Stephen J. Summers, *Differential geometry and mathematical physics*
Paul M. Gauthier, *Several complex variables*
Ladnor D. Geissinger, William H. Graves and L. Senechal, *Microcomputers and workstations in mathematics: teaching and research*
Joseph Glover and Arunava Mukherjea, *Probability on algebraic and topological structures*
Michel L. Lapidus and Robert S. Strichartz, *Fractal and spectral geometry*
Sung J. Lee and Y. You, *Operator methods for control problems*
R. Kent Nagle and Mary E. Parrott, *Nonlinear boundary value problems*
John F. Pedersen, W. Edwin Clark, W. Richard Stark, Jospeh J. Liang and Gregory L. McColm, *Mathematical issues in biologically motivated computing*
Donald St. P. Richards, *Hypergeometric functions on domains of positivity, jack polynomials, and applications*

June 1991 Meeting in Portland, Oregon
Western Section
Associate Secretary: Lance W. Small
Deadline for organizers: Expired
Deadline for consideration: March 5, 1991

August 1991 Meeting in Orono, Maine
Associate Secretary: Joseph A. Cima
Deadline for organizers: November 15, 1990
Deadline for consideration: May 8, 1991

October 1991 Meeting in Philadelphia, Pennsylvania
Eastern Section
Associate Secretary: W. Wistar Comfort
Deadline for organizers: January 10, 1991
Deadline for consideration: July 11, 1991
Daniel B. Szyld, *Numerical linear algebra*

October 1991 Meeting in Fargo, North Dakota
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: January 25, 1991
Deadline for consideration: July 11, 1991
Joseph P. Brennan and Sylvia M. Wiegand, *Commutative algebra*
Dogan Comez, *Ergodic theory*
Kendall E. Nygard, *Operations research*
James H. Olsen and Mark Pavicic, *Mathematical foundations of computer graphics*
Warren E. Shreve, *Graph theory*
Vasant A. Ubhaya, *Approximation theory*
Harald Upmeier, *Multivariate operator theory in symmetric domains*

November 1991 Meeting in Santa Barbara, California
Western Section
Associate Secretary: Lance W. Small
Deadline for organizers: February 7, 1991
Deadline for consideration: August 20, 1991

January 1992 Meeting in Baltimore, Maryland
Associate Secretary: Lance W. Small
Deadline for organizers: April 8, 1991
Deadline for consideration: September 11, 1991

March 1992 Meeting in Tuscaloosa, Alabama
Southeast Section
Associate Secretary: Joseph A. Cima
Deadline for organizers: June 13, 1991
Deadline for consideration: To be announced

March 1992 Meeting in Springfield, Missouri
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: June 26, 1991
Deadline for consideration: To be announced

June 1992 Meeting in Cambridge, England
Associate Secretary: Robert M. Fossum
Deadline for organizers: September 28, 1991
Deadline for consideration: To be announced

January 1993 Meeting in San Antonio, Texas
Associate Secretary: W. Wistar Comfort
Deadline for organizers: April 13, 1992
Deadline for consideration: To be announced

August 1993 Meeting in Vancouver, British Columbia, Canada
Associate Secretary: Lance W. Small
Deadline for organizers: November 11, 1992
Deadline for consideration: To be announced

January 1994 Meeting in Cincinnati, Ohio
Associate Secretary: Joseph A. Cima
Deadline for organizers: April 5, 1993
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

Information for Organizers

Special Sessions at Annual and Summer Meetings are held under the supervision of the Program Committee for National Meetings (PCNM). They are administered by the Associate Secretary in charge of that meeting with staff assistance from the Meetings and Editorial Departments in the Society office in Providence.

According to the "Rules for Special Sessions" of the Society, Special Sessions are selected by the PCNM from a list of proposed Special Sessions in essentially the same manner as Invited Speakers are selected. The number of Special Sessions at a Summer or Annual Meeting

is limited. The algorithm that determines the number of Special Sessions allowed at a given meeting, while simple, is not repeated here, but can be found in "Rules for Special Sessions" on page 614 in the April 1988 issue of *Notices*.

Each Invited Speaker is invited to generate a Special Session, either by personally organizing one or by having a Special Session organized by others. Proposals to organize a Special Session are sometimes requested either by the PCNM or by the Associate Secretary. Other proposals to organize a Special Session may be submitted to the Associate Secretary in charge of that meeting (who is an *ex-officio* member of the committee and whose address may be found below). These proposals must be in the hands of the PCNM at least nine months prior to the meeting at which the Special Session is to be held in order that the committee may consider all the proposals for Special Sessions simultaneously. Proposals that are sent to the Providence office of the Society, to *Notices*, or directed to anyone other than the Associate Secretary will have to be forwarded and may not be received in time to be considered for acceptance.

It should be noted that Special Sessions must be announced in *Notices* in such a timely fashion that any member of the Society who so wishes may submit an abstract for consideration for presentation in the Special Session before the deadline for such consideration. This deadline is usually three weeks before the deadline for abstracts for the meeting in question.

Special Sessions are very effective at Sectional Meetings and can usually be accommodated. The processing of proposals for Special Sessions for Sectional Meetings is handled in essentially the same manner as for Annual and Summer Meetings by the Section Program Committee. Again, no Special Session at a Sectional Meeting may be approved so late that its announcement appears past the deadline after which members can no longer send abstracts for consideration for presentation in that Special Session.

The Society reserves the right of first refusal for the publication of proceedings of any Special Session. These proceedings appear in the book series *Contemporary Mathematics*.

More precise details concerning proposals for and organizing of Special Sessions may be found in the "Rules for Special Sessions" or may be obtained from any Associate Secretary.

Proposals for Special Sessions to the Associate Secretaries

The programs of Sectional Meetings are arranged by the Associate Secretary for the section in question:

Western Section

Lance W. Small, Associate Secretary
Department of Mathematics
University of California, San Diego
La Jolla, CA 92093
Electronic mail: g_small@math.ams.com
(Telephone 619-534-3590)

Central Section

Andy R. Magid, Associate Secretary
Department of Mathematics
University of Oklahoma
601 Elm PHSC 423
Norman, OK 73019
Electronic mail: g_magid@math.ams.com
(Telephone 405-325-6711)

Eastern Section

W. Wistar Comfort, Associate Secretary
Department of Mathematics
Wesleyan University
Middletown, CT 06457
Electronic mail: g_comfort@math.ams.com
(Telephone 203-347-9411)

Southeastern Section

Joseph A. Cima, Associate Secretary
Department of Mathematics
University of North Carolina, Chapel Hill
Chapel Hill, NC 27599-3902
Electronic mail: g_cima@math.ams.com
(Telephone 919-962-1050)

As a general rule, members who anticipate organizing Special Sessions at AMS meetings are advised to seek approval at least nine months prior to the scheduled date of the meeting. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

Proposals for Special Sessions at the June 29-July 1, 1992, meeting in Cambridge, England, only should be sent to Professor Fossum at the Department of Mathematics, University of Illinois, Urbana, IL 6180, Telephone: 217-244-1741, Electronic mail: robert@odin.math.uiuc.edu.

Information for Speakers

A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting at which the Special Session has been scheduled. Contributors should know that there is a limitation in size of a single Special Session, so that it is sometimes true that all places are filled by invitation. Papers not accepted for a Special Session are considered as ten-minute contributed papers.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940) by the special deadline for Special Sessions, which is usually three weeks earlier than the deadline for contributed papers for the same meeting. The Council has

decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Electronic submission of abstracts is available to those who use the TEX typesetting system. Requests to obtain the package of files may be sent electronically via the Internet to **abs-request@math.ams.com.** 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, Publications Division, P.O. Box 6248, Providence, RI 02940, USA. When requesting the abstracts package, users should be sure to specify whether they want the plain TEX, AMS-TEX, or the LATEX package.

Number of Papers Presented

Joint Authorship

Although an individual may present only one ten-minute contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once. An author can speak by invitation in more than one Special Session at the same meeting.

An individual may contribute only one abstract by title in any one issue of *Abstracts*, but joint authors are treated as a separate category. Thus, in addition to abstracts from two individual authors, one joint abstract by them may also be accepted for an issue.

Site Selection for Sectional Meetings

Sectional Meeting sites are recommended by the Associate Secretary for the Section and approved by the Committee of Associate Secretaries and Secretary. Recommendations are usually made eighteen to twenty-four months in advance. Host departments supply local information, ten to twelve rooms with overhead projectors for contributed paper sessions and special sessions, an auditorium with twin overhead projectors for invited addresses, and registration clerks. The Society partially reimburses for the rental of facilities and equipment, and for staffing the registration desk. Most host departments volunteer; to do so, or for more information, contact the Associate Secretary for the Section.

COMBINATORIAL GROUP THEORY

Benjamin Fine, Anthony Gaglione and Francis C.Y. Tang, Editors

Contemporary Mathematics, Volume 109

The AMS Special Session on Combinatorial Group Theory—Infinite Groups, held at the University of Maryland in April 1988, was designed to draw together researchers in various areas of infinite group theory, especially combinatorial group theory, to share methods and results. The session reflected the vitality and interests in infinite group theory, with eighteen speakers presenting lectures covering a wide range of group-theoretic topics, from purely logical questions to geometric methods. The heightened interest in classical combinatorial group theory was reflected in the sheer volume of work presented during the session.

This book consists of eighteen papers presented during the session. Comprising a mix of pure research and exposition, the papers should be sufficiently understandable to the nonspecialist to convey a sense of the direction of this field. However, the volume will be of special interest to researchers in infinite group theory and combinatorial group theory, as well as those interested in low-dimensional (especially three-manifold) topology.

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Institutional member $30
To order, please specify CONM/109NA

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 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS (321-4267) in the continental U.S. and Canada to charge with Visa or MasterCard.

Joint Summer Research Conferences in the Mathematical Sciences

University of Washington, Seattle, June 22 to August 2, 1991

The 1991 Joint Summer Research Conferences in the Mathematical Sciences will be held at the University of Washington, Seattle, from June 22 to August 2. It is anticipated that the series of conferences will be supported by grants from the National Science Foundation and other agencies.

There will be eight conferences in eight different areas of mathematics. The topics and organizers for the conferences were selected by the AMS, Institute of Mathematical Statistics (IMS), and the Society for Industrial and Applied Mathematics (SIAM) Committee on Joint Summer Research Conferences in the Mathematical Sciences. The selections were based on suggestions made by the members of the committee and individuals submitting proposals. The committee considered it important that the conferences represent diverse areas of mathematical activity, with emphasis on areas currently especially active, and paid careful attention to subjects in which there is important interdisciplinary activity at present.

The conferences emulate the scientific structure of those held throughout the year at Oberwolfach. These conferences are intended to complement the Society's program of annual Summer Institutes and Summer Seminars, which have a larger attendance and are substantially broader in scope. The conferences are research conferences and are not intended to provide an entree to a field in which a participant has not already worked.

It is expected that funding will be available for a limited number of participants in each conference. Others, in addition to those funded, will be welcome, within the limitations of the facilities of the campus. In the spring a brochure of information will be mailed to all who are requesting to attend the conferences. The brochure will include information on room and board rates, the residence and dining hall facilities, travel, local information, and a Residence Housing Form to use to request on-campus accommodations. Information on off-campus housing will also be included in the brochure. Participants will be responsible for making their own housing and travel arrangements. Each participant will be required to pay nominal registration and social fees.

Those interested in attending one of the conferences should send the following information to the Summer Research Conference Coordinator, Meetings Department, American Mathematical Society, Post Office Box 6887, Providence, RI 02940 or by E-Mail: CAK@MATH.AMS.COM on the Internet.

Please type or print the following:

1. Title and dates of conference desired
2. Full name
3. Mailing address
4. Telephone number and area code for office, home and electronic-mail address
5. Member of AMS, IMS, or SIAM? If AMS, please give member code
6. Your scientific background relevant to the topic of the conference
7. Financial assistance requested; please estimate cost of travel
8. Indicate if support is not required and if interested in attending even if support is not offered.

The deadline for receipt of applications is March 1, 1991. Requests to attend will be forwarded to the Organizing Committee for each conference for consideration after the deadline of March 1. All applicants will receive a formal invitation and notification of financial assistance from the AMS. **Requests received past the deadline will be returned.** Funds available for these conferences are limited and individuals who can obtain support from other sources should do so. Women and members of minority groups are encouraged to apply and participate in these conferences.

Any questions concerning the scientific portion of the conference should be directed to the chair or any member of the Organizing Committee.

The Joint Summer Research Conferences in the Mathematical Sciences are under the direction of the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. The following committee members chose the topics for the 1991 conferences: John A. Burns, Fan R. K. Chung, Leonard Evens, Martin Golubitsky, Anthony W. Knapp, Ingram Olkin, Emanuel Parzen, Stewart B. Priddy, Stephen Simpson and Gregg J. Zuckerman.

N.B. Lectures begin on Sunday morning and run through Thursday.

Saturday, June 22 to Friday, June 28

Stochastic modeling and statistical inference for selected problems in biology

CHARLES SMITH (North Carolina State University), Co-Chair,

GRACE L. YANG (University of Maryland, College Park), Co-Chair

The conference will focus on problems in neuronal activity, the effect of radiation on single cells, DNA sequence analysis, and the transmission of infectious diseases.

Major advances in measurement techniques have generated an abundance of data and a need for concomitant advances in methods of analysis. Both the data and the new sampling techniques give rise to new problems in statistics and the demand for rethinking approaches to existing problems.

Markov processes and counting processes have been extensively used in the above biological research areas, e.g., in analyzing membrane channel data; studying the kinetic behavior of the ionic channels; searching DNA sequences for regions of similarity and aligning sequences; studying cell survivability, mutation, and inactivation under radiation; investigating transmission mechanisms of infectious diseases. Stochastic differential equation models have been used for investigating the depolorization of the membrane potential of neurons. Active research areas in statistical inference include model identification, parameter estimation in aggregated stochastic processes, mixture of distributions, confidence sets, and partially observed data.

These are emerging multidisciplinary research areas. Invited speakers will be from statistics, stochastic processes, and respective biological fields.

Members of the Organizing Committee: Gopinath Kalianpur (University of North Carolina) and Lucien Le Cam (University of California, Berkeley).

Saturday, June 22 to Friday, July 5

Graph minors

NEIL ROBERTSON (Ohio State University), Co-Chair

P.D. SEYMOUR (Bell Communications Research), Co-Chair

A minor of a graph G is obtained from a subgraph of G by contracting away some of its edges. It has been shown that any set of finite graphs in which no graph is isomorphic to a minor of another must be finite (i.e., that finite graphs are well-quasi-ordered). The proof is through a general theory giving a structural description of the graphs without a given graph as a minor. The same approach has resulted in an algorithm for the "k disjoint paths problem", with polynomially bounded running time for fixed k, and in several other consequences.

These theorems have been followed up by a considerable amount of research activity. Further progress has been made on "disjoint paths" problems in graphs on fixed surfaces; embeddings of graphs in 3-space without knotted circuits, or without knotted or linked circuits; structure theory for infinite graphs with a fixed infinite tree, grid, or complete graph excluded as a minor; theorems about highly "locally planar" surface embeddings of graphs; "separator" theorems; "second-order" well-quasi-ordering; and better-quasi-ordering of infinite trees with an "ordinal gap-condition". There are also recent related theorems in logic about Borel orders and the proof-theoretical analysis of well-quasi-ordering theorems. Furthermore, in algorithmic theory many NP-complete problems have been shown to have polynomial-time algorithms when restricted to graphs with structures arising in the theory of graph minors, such as tree-structures of bounded width and surface structures.

The conference will bring together leading researchers in these areas of graph theory, computer science, operations research, and logic. It is intended to stimulate further research on the open problems in the area which are approachable by the new techniques.

Members of the Organizing Committee: Harvey M. Friedman (Ohio State University) and Bruce Alan Reed (University of Waterloo).

Saturday, June 29 to Friday, July 5

Theory and applications of multivariate time series analysis

ROBERT H. SHUMWAY (University of California, Davis), Co-Chair

RUEY S. TSAY (University of Chicago), Co-Chair

The theory and applications of multivariate time series analysis represent the cutting-edge of advanced study of stochastic processes and statistical inferences. They include many interesting and challenging research problems such as multi-dimensional and higher order spectral analyses, exchangeable models, limiting theory of nonstationary processes, model building, co-integration, parameterization, and computing. Some nice results of these problems have been obtained in the literature; many of them are yet to be resolved. Therefore, the main objectives of the conference are (a) to investigate canonical representation of a process, (b) to discuss the recent development in multi-dimensional spectral analysis, (c) to study asymptotic theory of nonstationary processes, (d) to compare and discuss various model building procedures available in the literature, (e) to investigate the use of graphical methods in multivariate time series analysis, (f) to study the linear and non-linear dynamic of a system, and (g) to apply the theory and modeling methodology of multivariate time series analysis to var-

ious scientific fields such as engineering, biology, public health, geophysical sciences, and economics.

Members of the Organizing Committee: Steven C. Hillmer (University of Kansas) and Joseph H. Newton (Texas A & M University).

Note: We encourage recent Ph.D.'s, graduate students, and women in multivariate time series analysis to attend this conference.

Saturday, July 6 to Friday, July 12

Stochastic inequalities

MOSHE SHAKED (University of Arizona), Co-Chair

Y.L. TONG (Georgia Institute of Technology), Co-Chair

Stochastic inequalities play an important role in probability and statistics and are of use in many areas. This conference focuses on the recent developments in the theory and applications of stochastic inequalities with special emphasis on the following topics:

* Convexity-related, majorization-related inequalities and stochastic convexity,

* Dependence-related probability and moment inequalities,

* Optimal stopping-related and prophet inequalities,

* Inequalities in multivariate distributions and multivariate analysis,

* Inequalities in reliability theory and queueing theory,

* Applications in business and economics, contingency table analysis, operations research, statistical physics, and other related areas.

It is expected that the conference will provide an opportunity for interactions among developers and users of stochastic inequalities from diverse areas.

Members of the Organizing Committee: J.H.B. Kemperman (Rutgers University), Albert W. Marshall (University of British Columbia), and Frank Proschan (Florida State University).

Saturday, July 6 to Friday, July 12

Biofluiddynamics

A.Y. CHEER (University of California, Davis), Chair

C.P. VAN DAM (University of California, Davis), Co-Chair

Research in biofluiddynamics can be divided into two major areas: external biofluiddynamics which is concerned with animal flight and locomotion through the surrounding fluid media and internal biofluiddynamics which is mainly concerned with heat and mass transport by fluid flow within biological systems such as plants and animals. The fundamental goals of research in biofluiddynamics are not only to understand the mechanisms used by these biological systems to locomote or transport internal fluids, but also to obtain an understanding of their evolution.

The aims of this conference in biofluiddynamics include:

(1) to provide the mathematicians, engineers, physiologists, and biologists a forum to discuss problems of mutual interest with the goal of leading to effective collaboration on research projects,

(2) to point out the richness of the field from the fluid dynamicist's point of view, and

(3) to point out that questions in fluid dynamics, suggested by the study of biological problems, have not been tackled during all the vast development of knowledge in fluid dynamics aimed mainly at engineering applications.

Example subjects of discussion are:

External Flows:

High Reynolds number flows:

Flapping flight, wing optimization, locomotion of large aquatic animals

Movements of currents and their effects on plankton

Unsteady vortex flow, hovering flight

Low Reynolds number flows:

Microorganism locomotion, sperm motility

Particle capture (feeding) from low-speed laminar flows

Internal Flows:

High Reynolds number flows:

Flow through large blood vessels, arteries, and the heart

Artificial heart calculations

Flow in urea, kidney and collapsible tubes

Pulmonary fluids, instability of coughing

Low Reynolds number flows:

Microcirculation, flow in capillaries and arterios

Members of the Organizing Committee: S. Berger (University of California, Berkeley), D. Kwak (NASA-Ames Research Center), and A. Mayo (IBM T.J. Watson Research Center).

Saturday, July 13 to Friday, July 19

No conference scheduled

Saturday, July 20 to Friday, August 2

Motives

STEVEN KLEIMAN (Massachusetts Institute of Technology), Co-Chair

KARI VILONEN (Brandeis University), Co-Chair

The theory of motives was introduced in the middle 1960's by Grothendieck to explain the analogies among the various cohomology theories for algebraic varieties, to play the role of the missing integral cohomology, and to provide a blueprint for proving Weil's conjectures about the zeta function of a variety over a finite field. Remarkably, over the last ten years or so, researchers in various fields – Hodge theory, algebraic K-theory, au-

tomorphic forms, L-functions, l-adic representations, trigonometric sums, and algebraic cycles – have discovered that an enlarged (and in part conjectural) theory of "mixed" motives indicates and explains phenomena appearing in each field. Thus the theory has the potential of enriching each field and of unifying them all.

The purpose of the conference is to bring together researchers from these diverse fields to discuss their work, discover common features through the theory of motives, and reap the benefits. There will be about forty invited one-hour lectures, most of them aimed at the nonspecialist. The lectures will cover the following areas, among others: (1) Grothendieck's "standard" conjectures, on which he based his theory of motives; (2) the theory of motivic Galois groups and their representations; (3) the theory of automorphic representations, including the conjectures of Langlands; (4) the constructions of motives and motivic cohomology using absolute Hodge cycles, algebraic K-theory, algebraic cycles, Grassmannians, and perverse sheaves; (5) the structure of the categories of mixed motives and motivic sheaves, of mixed l-adic sheaves and mixed Hodge modules; (6) applications to special values of iterated integrals (for example, polylogarithms) and to the behavior of L-functions at integral points, including the conjectures of Beilinson and Deligne.

Members of the Organizing Committee: Alexander Beilinson (Moscow and Massashusetts Institute of Technology), Pierre Deligne (Institute for Advanced Study), Uwe Jannsen (MPI), Robert MacPherson (Massachusetts Institute of Technology) and Jean-Pierre Serre (College de France).

Saturday, July 20 to Friday, July 26

Mathematical aspects of classical field theory

MARK J. GOTAY (United States Naval Academy), Co-Chair

JERROLD E. MARSDEN (University of California, Berkeley), Co-Chair

VINCENT E. MONCRIEF (Yale University), Co-Chair

Classical field theory has undergone a renaissance during the past several years. Symplectic techniques have yielded deep insights into its foundations, e.g., the emerging role of momentum mappings and their relations to initial value constraints and the stratified structure of solution spaces. A much improved understanding of the variational calculus has also been a contributing factor. Further impetus for the study of classical field theory comes from related areas. A case in point is BRST symmetry in quantum field theory, which is now realized to have a classical counterpart. Progress has likewise been made recently in specific theories, such as relativity, where the full force of global analysis has been brought to bear with striking results.

The conference will be devoted to exploring and developing mathematical techniques relevant to the study of classical fields. Although the main focus is on elucidating the structure of classical field theories, related topics with a "classical" basis, such as geometric theories of quantization, will also be discussed. Mathematical aspects of relativity theory will be given particular emphasis.

Topics to be covered during the conference include:

1. CALCULUS of VARIATIONS
   - *higher order field theories
   - *multisymplectic structures
   - *exterior differential systems
   - *symmetries
2. MATHEMATICAL STRUCTURE of CLASSICAL FIELD THEORIES
   - *classical BRST formalism
   - *geometric aspects of quantization
   - *momentum mappings and their relation to anomalies and initial value constraints
   - *Dirac theory of constraints
3. GLOBAL ANALYSIS and MATHEMATICAL RELATIVITY
   - *initial value problem
   - *formation of singularities, cosmic censorship
   - *new variables
   - *asymptotics

Saturday, July 27 to Friday, August 2

Systems of coupled oscillators

D.G. ARONSON (University of Minnesota, Minneapolis) Chair

Systems of oscillators, both forced and coupled, arise in many areas of science and engineering and have attracted the attention of many mathematicians. Much of the literature is focused on forced oscillators since they are somewhat more amenable to mathematical analysis. However, there has been a great deal of recent progress on coupled systems, so that it seems highly appropriate to bring together some of the major contributors in an attempt to take stock and map out directions for future research.

Specifically, the conference will focus on three main areas: Theory (including recent work on small systems, systems equivariant with respect to some symmetry group, and large systems close to continuum limit); applications and experiments (including recent work on central pattern generators, chemical oscillators, and Josephson junction circuits); numerical methods and tools (including symbolic calculation and various useful software packages such as AUTO, PhasePlane, and kaos).

Members of the Organizing Committee: E.J. Doedel (Concordia University), G. B. Ermentrout (University of Pittsburgh) and Mark Roberts (University of Warwick).

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. (Information on meetings of the Society, and on meetings sponsored by the Society, will be found inside the front cover.)

AN ANNOUNCEMENT will be published in *Notices* if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second full 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 *Notices*, care of the American Mathematical Society in Providence.

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 *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 *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.

1990. **IMACS International Workshop on Massively Parallel Methods in Computational Physics**, Boulder, Colorado. (Sep. 1989, p. 914)

1990. **IMACS Conference on Computer Aided Design**, Yugoslavia. (Sep. 1989, p. 914)

1990. **CWI-IMACS Symposia on Parallel Scientific Computing**, Amsterdam, The Netherlands. (Feb. 1990, p. 216)

1990. **Concentration Year on Stochastic Models, Statistical Methods, and Algorithms in Image Analysis**, Rome, Italy. (Apr. 1990, p. 491)

1990–1991. **Academic Year Devoted to Operator Theory and Complex Analysis**, Mittag-Leffler Institute, Djursholm, Sweden. (Dec. 1989, p. 1432)

November 1990

16–17. **Tenth Annual Southeastern-Atlantic Regional Conference on Differential Equations**, Virginia Polytechnic Institute and State University, Blacksburg, VA. (May/Jun. 1990, p. 610)

18–24. **Komplexitätstheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

19–22. **Huygens' Principle 1690-1990, Theory and Applications**, Scheveningen, The Hague, The Netherlands. (May/Jun. 1990, p. 610)

21–23. **Colloque Franco-Belge de Statistique**, Marseille, France. (Jul./Aug. 1990, p. 740)

25–28. **Mathematics and its Applications**, University of Bahrain, State of Bahrain. (May/Jun. 1990, p. 610)

25–December 1. **Stochastische Approximation Und Optimierungsprobleme In Der Statistik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

25–December 1. **Lineare Modelle und Multivariate Statistische Verfahren**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 769)

26–30. **Seminaire Sud-Rhodanien de Geometrie Differentielle**, Marseille, France. (Jul./Aug. 1990, p. 741)

December 1990

December 1990. **Structural Complexity and Cryptography**, Rutgers University, New Brunswick, NJ. (Oct. 1990, p. 1135)

2–8. **Multigrid Methods**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

3–5. **First International Symposium on Uncertainty and Analysis: Fuzzy Reasoning, Probabilistic Methods and Risk Management**, College Park, Maryland. (Oct. 1989, p. 1098)

3–7. **Sixteenth Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**, Palmerston North, New Zealand. (Feb. 1990, p. 226)

3–7. **SINO-JAPANESE Joint Seminar on Nonlinear PDEs with Emphasis on Reaction-Diffusion Aspects.**, Taipei, Taiwan. (Jan. 1990, p. 61)

3–7. **Workshop on General Group Representation Theory**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1990, p. 61)

9–11. **Canadian Mathematical Society Winter Meeting**, University of Waterloo, Ontario. (Sep. 1990, p. 933)

9–14. **International Conference on Math-**

ematical Theory of Control, I.I.T. Bombay. (Sep. 1990, p. 933)

9–15. **Allgemeine Ungleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

11–12. **Integral Valued Polynomials Encounter**, CIRM, Marseille, France. (Jul./Aug. 1990, p. 741)

11–13. **Third Joint IFSA-EC and EURO-WG Workshop on Fuzzy Sets**, Visegrád, Hungary. (May/Jun. 1990, p. 611)

15–19. **Curves and Surfaces: An Algorithmic Viewpoint**, Kent State Univ., Kent, OH. (Apr. 1990, p. 499)

16–22. **Mathematische Logik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

17–21. **Non-linear Dispersive Wave Systems**, Univ. of Central Florida, Orlando, FL. (Apr. 1990, p. 499)

17–21. **International Conference on Theory of Differential Equations and Applications to Oceanography**, Goa University, Bamboli, St. Cruz, India. (Sep. 1990, p. 933)

25–January 1. **Lineare Modelle Und Multivariate Statistische Verfahren**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

27–31. **Holiday Symposium on Recent Developments in Homotopy Theory**, New Mexico State Univ., Las Cruces, NM. (Jul./Aug. 1990, p. 741)

1991. **IMACS Symposium on Parallel and Distributed Computing in Engineering Systems**, Athens, Greece. (Jul./Aug. 1990, p. 741)

Spring 1991. **IMACS International Symposium on Iterative Methods in Linear Algebra**, Brussels Free Univ., Brussels, Belgium. (Mar. 1990, p. 334)

January 1991

January 1991. **Circuit and Communication Complexity**, Rutgers University, New Brunswick, NJ. (Oct. 1990, p. 1136)

6–12. **Automorphe Formen und Anwendungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

7–9. **SIAM Workshop on Automatic Differentiation of Algorithms: Theory, Implementation, and Application**, Breckenridge, CO. (Jul./Aug. 1990, p. 741)

7–10. **Sixth Caribbean Conference in Combinatorics and Computing**, University of the West Indies, St. Augustine, Trinidad. (Jan. 1990, p. 61)

7–11. **NATO Advanced Research Workshop on Asymptotics Beyond All Orders**, La Jolla, CA. (Oct. 1990, p. 1136)

13–19. **Combinatorical Optimization**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

14–15. **AMS Short Course on "Probabilistic Combinatorics and its Applications"**, San Francisco, CA.

INFORMATION: D. Plante, AMS, P.O. Box 6248, Providence, RI 02940.

16–19. **Joint Mathematics Meetings**, San Francisco, CA. (including the annual meetings of the AMS, AWM, MAA, and NAM)

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

* 20. **Informal Workshop on the Teaching of Calculus**, San Francisco, CA. (Please note change from Sep. 1990, p. 933)

INFORMATION: G. Strange, Room 2-240, Massachusetts Institute of Technology, Cambridge, MA 02139.

20–26. **Spektraltheorie Singulärer Gewöhnlicher Differentialoperatoren**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

* 21–25. **IMA Workshop on Statistical Thermodynamics and Differential Geometry of Microstructured Material**, University of Minnesota, Minneapolis, MN. (Please note changes from Sep. 1990, p. 933)

SPONSORS: This workshop is sponsored jointly with the Center for Interfacial Engineering.

27–February 2. **Harmonische Analyse und Darstellungstheorie Topologischer Gruppen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

28–30. **Second ACM-SIAM Symposium on Discrete Algorithms**, San Francisco, CA. (Jul./Aug. 1990, p. 741)

February 1991

3–9. **Konstruktive Methoden in der Komplexen Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

4–8. **Winter School on Infinite Dimensional Differential Geometry**, Wien, Austria. (Sep. 1990, p. 934)

10–16. **Endlichdimensionale Lie-Algebren**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

10–16. **Affine Differentialgeometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

11–15. **The Twenty-Second Southeastern International Conference on Combinatorics, Graph Theory and Computing**, Louisiana State University, Baton Rouge, LA. (Oct. 1990, p. 1136)

17–23. **Experimentelle, Insbesondere Computergraphische Methoden in der Mathematik**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 742)

* 17–23. **Krein Spaces and Applications to Differential Operators**, Oberwolfach, Federal Republic of Germany. (Please note additional information from Jul./Aug. 1990, p. 742)

PLENARY LECTURES: M. Anliker, ETH Zürich (Macro- and microskopic biomedical research); H. Bandemer, Bergakademie Freiberg (Unscharfe Datenanalyse); F. Goerisch, TU Clausthal (Parameterabhängige Eigenwertaufgaben in den Natur und Ingenieurwissenschaften: Ausweichphänomene und Einschliebungsmethoden); H. Lippmann, TU München (Advances in the theory of translatory coal outbursts); O. Olejnik, MGU Moscow (Mathematical problems in elasticity); P. Perzyna, IPPT-PAN Warsaw (Fracture phenomena in dynamic loading processes); I. Ryhming, Ecole Polytechnique Lausanne (Numerical simulation of the flow in water turbines); E. Stein, Univ. Hannover (FE-Methods in nonlinear structures mechanics); J. Wittenburg, Univ. Karlsruhe (Theoretische und angewandte mehrkörpermechanik); J. Zabczyk, IM-PAN Warsaw (On minimum energy problems); F. Ziegler, TU Wien (Developments in structural dynamic viscoplasticity including ductale damage); H. Zorski, IPPT-PAN Warsaw (Dipole dynamics: Discrete and continuous distribution). **The Ludwig-Prandtl-Memorial Lecture will be given by Dr.-Ing. E. h. Julius C. Rotta, DLR Göttingen on Aspekte turbulenter Grenzschichten.**

MINISYMPOSIA: Three topics: Applied

analysis, optimization of structures, and exact numerical algorithms for differential and integral equations.
CALL FOR PAPERS: The length of the manuscript must not exceed five pages in standard, double-spaced typing for the short lectures. Deadline: April 22, 1991.
INFORMATION: GAMM-Congress 1991, G. Szefer, Inst. of Structures Mechanics, Cracow Univ. of Techn., ul. Warszawska 24, PL-31-155 Krakow; tel: 33-84-51; Teletex: 322 468 pk pl; Telefax: 4812/335 773.

18–23. **Ninth International Seminar on Model Optimization in Exploration Geophysics, with a Workshop on Geophysical Data Inversion in Archeological Site Investigation**, Berlin, Free University of Berlin, Mathematical Geophysics Group and Archeological Institute. (Oct. 1990, p. 1136)

24–March 2. **Medical Statistics: Statistical Models for Longitudinal Data**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

25–March 1. **IEEE Computer Society COMPCON Spring '91**, San Francisco, CA. (Jan. 1990, p. 62)

March 1991

March 1991. **Computational Number Theory**, Rutgers University, New Brunswick, NJ. (Oct. 1990, p. 1136)

3–9. **Partielle Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

4–15. **Workshop on Mathematical Physics and Geometry**, Trieste, Italy. (Sep. 1990, p. 934)

5–7. **Association for Computing Machinery 1991 Computer Science Conference**, San Antonio Convention Center, San Antonio, TX. (May/Jun. 1990, p. 611)

7–8. **Twenty-second ACM SIGCSE Technical Symposium on Education in the Computing Sciences**, San Antonio, TX. (May/Jun. 1990, p.612)

7–10. **International Conference on Differential Equations**, Cadi Ayyad University, Marrakech, Morocco. (May/Jun. 1990, p.612)

* 10–14. **International Conference on Inverse Problems: Computational Algorithms**, Texas A&M University, College Station, TX.
PROGRAM: The area of concentration will be the recovery of unknown coefficients in differential equations with a particular emphasis on constructive methods. Topics will include inverse spectral problems, inverse scattering problems, impedance tomography.
INFORMATION: M. Pilant or W. Rundell, Dept. of Math., Texas A&M Univ., College Station, Texas 77843-3368; email: mpilant@gauss.tamu.edu or rundell@newton.tamu.edu.

10–16. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

11–15. **NSF-CBMS Regional Research Conference on Nonlinear Dispersive Wave Systems**, University of Central Florida, Orlando, FL. (Jul/Aug. 1990, p. 742)

11–15. **IMA Workshop on Free Boundaries in Viscous Flows**, University of Minnesota, Minneapolis, MN. (Sep. 1990, p. 934)

13–15. **IMACS Workshop on Decision Support Systems and Qualitative Reasoning**, LAAS-Toulouse, France. (May/Jun. 1990, p. 612)

13–16. **Twenty-Second Annual Iranian Mathematics Conference**, Ferdowsi University of Mashhad, Iran. (Sep. 1990, p. 934)

14–16. **Sixth S.E.A. Meeting, Southeastern Approximation Theorists Annual Meeting**, Memphis State Univ., Memphis, TN. (Sep. 1990, p. 934)

16–17. **Central Section**, Indiana University, South Bend, IN.
INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

17–23. **Elementare und Analytische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

17–24. **Sixth International Conference on Geometry**, University of Haifa, Israel. (May/Jun. 1990, p. 612)

22–23. **Southeastern Section**, University of South Florida, Tampa, FL.
INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

22–24. **Fifth SIAM Conference on Parallel Processing for Scientific Computing**, Houston, TX. (Mar. 1990, p. 334)

24–30. **Gewöhnliche Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

25–27. **Fifth SIAM Conference on Parallel Processing for Scientific Computing**, Houston, TX. (Jul./Aug. 1990, p. 742)

25–28. **International Conference on Mathematical Linguistics - ICML '91**, Barcelona, Spain. (Jul./Aug. 1990, p. 742)

31–April 6. **Arbeitsgemeinschaft mit Aktuellum Thema**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

April 1991

1–4. **Eighth International Conference on Mathematical and Computer Modeling**, University of Maryland, College Park, MD. (Oct. 1990, p. 1137)

2–4. **IMACS International Symposium on Iterative Methods in Linear Algebra**, Brussels Free Universities, Belgium. (May/Jun. 1990, p. 612)

7–13. **Algebraische Gruppen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

8–12. **Seventh International Conference on Data Engineering**, Kobe, Japan. (Apr. 1990, p. 500)

8–12. **NASECODE VII, The Seventh International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits**, Copper Mountain, Colorado. (May/Jun. 1990, p. 612)

10–12. **Fourth International Conference on Rewriting Techniques and Applications (RTA-91)**, Como, Italy. (Jul./Aug. 1990, p. 743)

11–13. **Twenty-Fifth Annual Spring Topology Conference**, California State University, Sacramento, CA. (Oct. 1990, p. 1137)

11–16. **Assessment in Mathematics Education and Its Effects**, Calonge (Costa Brava), Spain. (Sep. 1990, p. 935)

14–20. **Brauer Groups and Representation Theory of Finite Groups**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

15–19. **IMA Workshop on Variational Problems**, University of Minnesota, Minneapolis, MN. (Sep. 1990, p. 935)

18–20. **Determinantal Ideals and Representation Theory**, University of Arkansas, Fayetteville, Arkansas. (Sep. 1990, p. 935)

* 21–24. **SUPER!: Supercomputing by University People for Education and Research**, Park City, UT.

PROGRAM: SUPER! is a higher education user group dedicated to issues of high-performance computing on IBM systems. SUPER!'s annual meeting will consist of presentations and discussions on a wide variety of related topics, including novel uses, user needs, product directions, training and support, international exchange, networks, visualization, performance, algorithms and program conversion.
INFORMATION: J. Facelli or D.-A. Raynor, Utah Supercomputing Institute, 3330 MEB, The University of Utah, Salt Lake City, UT 84112; 801-581-5253; FAX: 801-581-8692; email: SUPER@vm.usi.utah.edu.

21–27. **Numerical Linear Algebra**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 743)

23–26. **Mathematical and Numerical Aspects of Wave Propagation Phenomena**, Strasbourg, France. (Jul./Aug. 1990, p. 743)

26–28. **Similarity Solutions of Differential Equations**, University of Pittsburgh, PA. (Oct. 1990, p. 1137)

28–May 4. **Deductive Systems**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

* 29–May 2. **Joint U.S.-French Workshop on Applied Stochastic Analysis**, Rutgers University, New Brunswick, NJ.

CONFERENCE TOPICS: Singular stochastic control, queueing networks, stochastic optimization and filtering, adaptive control, estimation for random fields.
INVITED SPEAKERS: R. Azencott (Plenary), A. Bensoussan, M. Harrison, P. Kumar, P.L. Lions, E. Pardoux, J.M. Steele.
INFORMATION: D. Ocone or I. Karatzas, Math. Dept., Rutgers Univ., New Brunswick, NJ 08903; email: ocone@math.rutgers.edu; FAX: 201-932-5530.

May 1991

* May/June 1991. **Summer Workshop on Calculus, Computer, Concepts, and Cooperative Learning**, Purdue University, West Lafayette, IN.

PROGRAM: The two-week, intensive, total-immersion program will focus on the use of computers, research into learning theory, and a cooperative learning environment to help students learn calculus concepts. A three-day pre-workshop tutorial on the basic use of the necessary computer systems will be offered as an option. Participants are expected to return the following summer for two days to discuss their teaching experiences based on the workshop. The program will provide hands-on experience with computer software (both MS DOS and Macintosh), class materials, and seminars on learning theory, including viewing and discussing videos of Purdue classroom and laboratory experiences in cooperative learning. The program will feature the use of the mathematical programming language *ISETL* and its graphics package, in addition to the symbolic computer systems *Maple* and *Derive*. Participants will be encouraged to consider piloting the Calculus course presented in the workshop during AY 1991-92.
INFORMATION: E. Dubinsky or K. Schwingendorf, Dept. of Math., Purdue Univ., West Lafayette, IN 47907; email: bbf@j.cc.purdue.edu or ks@math.purdue.edu. Completed applications due by February 15, 1991. Partial support for attending the workshop will be available.

May/June 1991. **IMACS Workshop on Decision Support Systems and Qualitative Reasoning**, Toulouse, France. (Mar. 1990, p. 334)

2–3. **Twenty-Second Annual Pittsburgh Conference on Modeling and Simulation**, University of Pittsburgh, PA. (Sep. 1990, p. 935)

* 2–4. **International Conference on Polynomials with concentration at low degrees: From Analysis and Number Theory to Computer Science and Symbolic Computation**, Paris, France.

PROGRAM: Concentration at low degrees for polynomials is a concept which allows quantitative estimates, independent of the degree. Existing applications include: Functional analysis, harmonic analysis, numerical analysis, number theory, symbolic computation with computer implementation. The aim of the conference is to bring together specialists of these various fields, and discuss their links.
ORGANIZING COMMITTEE: B. Beauzamy (I.C.M., Paris), P. Enflo (Kent State Univ.).
INVITED SPEAKERS: B. Beauzamy (I.C.M., Paris), P. Enflo (K.S.U.), H.L. Montgomery (Ann Arbor, MI), L. Tzafriri (Jerusalem), R. Varga (K.S.U.), P. Wang (K.S.U.), A. Yger (Bordeaux), H. Zassenhaus (O.S.U.).
INFORMATION: Institut de Calcul Math. (I.C.M.), Univ. de Paris 7, 2 Place Jussieu, 75251 Paris Cedex 05- France.

5–11. **Darstellungstheorie Endlich-Dimensionaler Algebren**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 743)

6–8. **Fifth SIAM International Symposium on Domain Decomposition Methods for Partial Differential Equations**, Norfolk, VA. (Jul./Aug. 1990, p. 743)

7–10. **IMACS Symposium on Modelling and Simulation of Control Systems**, Casablanca, Morocco. (Mar. 1990, p. 334)

7–14. **Singapore Number Theory Workshop**, National Univ. of Singapore, Kent Ridge, Singapore. (Jul./Aug. 1990, p. 743)

* 9–11. **A Conference on History, Geometry, and Pedagogy in honor of the 80th birthday of Howard Eves**, University of Central Florida, Orlando, FL.

INVITED SPEAKERS: C. Dodge, P. Hilton, M. Klamkin, B. Meserve, F. Rickey, M. Senechal and H. Eves.
CALL FOR PAPERS: There will be parallel sessions for 25-minute contributed papers in the history of mathematics, in geometry, and in mathematics education. There will also be 50-minute workshops in mathematics education intended to give secondary school teachers ideas they can use in the classroom. Send an abstract of the talk or workshop to the address below. Abstracts must be received by March 1, 1991. Abstracts should be one paragraph summaries of the paper or workshop that are approximately 100 words long.
INFORMATION: J. Anthony, Dept. of Math., Univ. of Central Florida, Orlando, FL 32816-6990; 407-823-2700; FAX 407-281-5156.

12–18. **Nichtlineare Evolutionsgleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

13–17. **Conference in Harmonic Analysis in Honor of E.M. Stein**, Princeton

University, Princeton, NJ. (Mar. 1990, p. 334)

13–18. **IMA Workshop on Degenerate Diffusions**, University of Minnesota, Minneapolis, MN. (Sep. 1990, p. 935)

15–17. **Third IEEE Conference on Computer Workstations: Accomplishments and Challenges**, Falmouth (Cape Cod), MA. (Sep. 1990, p. 936)

17–20. **Conference/Workshop on Continuum Theory and Dynamical Systems**, University of Southwestern Louisianna, Lafayette, LA. (Sep. 1990, p. 936)

19–25. **Differentialgeometrie im Grossen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

20–24. **Eleventh International Conference on Distributed Computing Systems**, Arlington, TX. (Sep. 1990, p. 936)

22–24. **Second International Conference on Algebraic Methodology and Software Technology, (AMAST)**, Iowa City, IA. (Apr. 1990, p. 501)

26–31. **Signal Theory and Image Processing**, Cetraro, Italy. (Sep. 1990, p. 936)

26–June 1. **Optimalsteuerung und Variationsrechnung-Optimal Control**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

29–June 1. **Eighth Biennial Conference of the Association of Christians in the Mathematical Sciences**, Wheaton College, Wheaton, IL. (Jul./Aug. 1990, p. 743)

29–June 1. **Methods in Module Theory**, University of Colorado, Colorado Springs, CO. (Sep. 1990, p. 936)

* 30–31. **Special Session on Polymer Configurations: Nonlinear and Nonlocal Diffusion Problems**, University of Minnesota, Minneapolis, MN. (Please note changes in date and program from Sep. 1990, p. 937)

PROGRAM: This special session will constitute the first two days (and the more mathematical part) of Tethered Chains I: A Symposium on the Science of Polymeric Surfactants, May 30–June 3, 1991. May 30–31 will be held at the Univ. of Minnesota and June 1–3 will be held in northern Minnesota.

June 1991

2–8. **Diskrete Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

3–7. **1991 Annual Meeting of the Statistical Society of Canada**, Toronto, Ontario, Canada. (Mar. 1990, p. 334

* 3–8. **International Singularity Conference**, Lille, France.

PROGRAM: This conference will cover singularities in algebraic topology, geometry and algebraic geometry. There will be general lectures on the subject and a program of shorter talks.
INFORMATION: Congrès Singularités Mathématiques, USTL, 59655 Villeneuve d'Ascq Cedex (France); email: brassele@frcitl81.bitnet.
ORGANIZERS: J.P. Brasselet and D. Lehmann.

* 3–13. **Fifth International Workshop in Analysis and its Applications**, Kupari-Dubrovnik, Yugoslavia.

ORGANIZING COMMITTEE: A.R. Blass, Univ. of Michigan, Ann Arbor; A. Keschris, California Institute of Technology; C.V. Stanojevic, Univ. of Missouri-Rolla; G. Takeuti, Univ. of Illinois; A. Telyakovskii, Steklov Mathematical Institute-Moscow.
CALL FOR PAPERS: Send abstracts to A.R. Blass, Dept. of Math., Univ. of Michigan, 3220 Angel Hall, Ann Arbor, MI 48109-1003. Deadline for abstracts: January 1, 1991.
INFORMATION: C.V. Stanojevic, International Workshop in Analysis and its Applications, Dubrovnik-Kupari, Yugoslavia.

* 9–12. **International Workshop on Elementary Operators and Applications**, Heinrich Fabri-Institut der Universität Tübingen, Blaubeuren/Ulm, Federal Republic of Germany.

CONFERENCE TOPICS: General theory of elementary operators on rings, Banach algebras, and operator algebras; connections to related fields such as operator equations, multiparameter spectral theory, derivations and automorphisms, completely bounded operators, as well as applications to, e.g., Hilbert space operators, operator convex functions, differential equations, mathematical physics.
INVITED SPEAKERS: R.E. Curto, L.A. Fialkow.
CALL FOR PAPERS: Time will be alloted for contributed talks of about 20-30 minutes duration. Titles and abstracts of papers should be received by May 1, 1991.
INFORMATION: M. Mathieu, Mathematisches Institut, Univ. Tübingen, Auf der Morgenstelle 10, D-7400 Tübingen, F.R.G.; email: mima001@convex.zdv.uni-tuebingen.de.

9–14. **Second International Conference on Fixed Point Theory and Applications**, Dalhousie University, Halifax, Nova Scotia, Canada. (Oct. 1990, p. 1138)

9–15. **Singuläre Störungsrechnung**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

10–14. **Bernoulli Society Twentieth Conference on Stochastic Processes and their Applications**, Nahariya, Israel. (Nov. 1989, p. 1254)

13–15. **Western Sectional Meeting**, Portland State University, Portland, Oregon.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

14–17. **Symposium on Lattice Theory and its Applications, in Honor of the 80th Birthday of Garrett Birkhoff**, Darmstadt, Federal Republic of Germany. (Oct. 1990, p. 1138)

* 16–19. **Bar-Ilan Symposium on the Foundations of Artificial Intelligence**, Ramat Gan, Israel.

PROGRAM: The symposium is international in scope, with invited lectures by leading researchers and contributed papers on foundations of AI. This biennial event focuses on a range of topics of concern to scholars applying quantitative, combinatorial, logical, algebraic and algorithmic methods to AI areas as diverse as decision support, automatic reasoning, knowledge-based systems, machine learning, computational linguistics, computer vision, and robotics.
INVITED LECTURES: H. Berliner (Carnegie Mellon), New perspectives on search; E. David (Courant), Actions and continuous time; M. Golumbic (IBM Israel and Bar-Ilan), Mathematics in artificial intelligence; S. Peters (Stanford), Computationally relevant properties of linguistic systems.
CALL FOR PAPERS: Submissions of extended abstracts of 4–10 pages or full papers must arrive by 1 March

1991 and should be sent in triplicate to: (For General sessions), M. Koppel, Dept. of Math. and Comp. Sci., Bar-Ilan Univ., Ramat Gan, Israel; email: koppel@bimacs.bitnet; or (For Special track on theoretical issues in NLP), Inst. of Math. and Comp. Sci., The Hebrew Univ., Ross Building, Giv'at Ram, Jerusalem, Israel; email: rimon@humus.bitnet.

INFORMATION: A. Frank, BISFAI-91 Organizing Chair, Dept. of Math. and Comp. Sci., Bar-Ilan Univ., Ramat Gan, Israel; email: ariel@bimacs.bitnet.

17–21. **1991 International Symposium on the Mathematical Theory of Networks and Systems (MTNS-91)**, International Conference Center Kobe, Kobe, Japan. (Nov. 1989, p. 1254)

17–21. **European Conference on Elliptic and Parabolic Problems**, Pont á Mousson, France. (May/Jun. 1990, p. 613)

23–29. **Mathematische Methoden des VLSI-Entwurfs und des Distributed Computing**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 744)

26–28. **Third IMACS International Symposium on Computational Acoustics**, Harvard University, Cambridge, MA. (Jul./Aug. 1990, p. 744)

* 30–July 3. **Sixth Annual Conference on Structure in Complexity Theory**, University of Chicago, Chicago, IL.

PROGRAM COMMITTEE: J. Balcazar, A. Borodin, W. Gasarch, N. Immerman, C. Papadimitriou, W. Ruzzo, P. Vitanyi, C. Wilson.

CONFERENCE TOPICS: All areas of computational complexity theory, including: Structure of complexity classes, relativizations, independence results, applications of recursion theory and of finite model theory, random and interactive proof systems, cryptographic complexity, parallel complexity classes, and circuit complexity.

CALL FOR PAPERS: Send 10 copies of an extended abstract or a full paper to the program chair: N. Immerman, Dept. of Computer & Inf. Sci., Univ. of Massachusetts, Amherst, MA 01003. Deadline: January 23, 1991.

INFORMATION: J. Royer, School of Computer & Inf. Sci., Syracuse Univ., Syracuse, NY 13244; email: structures@top.cis.syr.edu.

30–July 6. **Elliptische Operatoren auf Singulären und Nichtkompakten Mannigfaltigkeiten**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

July 1991

1–5. **The Mathematics of Nonlinear Systems**. University of Bath, United Kingdom. (Oct. 1990, p. 1138)

2–5. **European Control Conference**, Grenoble, France. (Jul./Aug. 1990, p. 744)

* 4–11. **International Conference on Algebraic Topology**, Oaxtepec, Mexico.

PROGRAM: Both invited lectures and contributed talks, with emphasis on homotopy theory. Banquet in honor of Mark Mahowald's 60th birthday. Viewing of total solar eclipse.

INFORMATION: P. Shick, Math. Dept., John Carroll Univ., University Heights, OH 44118; shick@jcuvax.bitnet.

* 7–12. **Fifth Gregynog Symposium on Differential Equations**, University of Wales, UK.

INFORMATION: The symposium is financed by the Science and Engineering Research Council and participation is by invitation. Contact N.G. Lloyd, Dept. of Math., The University College of Wales, Aberystwyth, Dyfed, SY23 3BZ, UK.

7–13. **Computational Number Theory**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 744)

8–12. **Second International Conference on Industrial and Applied Mathematics**, Washington, DC. (Apr. 1990, p. 501)

8–12. **NATO Advanced Research Workshop: Approximation by Solutions of Partial Differential Equations, Quadrature Formulae, and Related Topics**, Hanstholm, Denmark. (Oct. 1990, p. 1139)

8–12. **Thirty-Fifth Annual Conference of the Australian Mathematical Society**, Melbourne, Australia. (Oct. 1990, p. 1139)

8–14. **ICOR '91 International Conference on Radicals**, Szekszárd, Hungary. (Apr. 1990, p. 502)

14–20. **Dynamische Systeme**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 502)

15–17. **Fifth IFAC/IMACS Symposium on Computer Aided Design in Control and Engineering Systems**, Swansea, UK. (Mar. 1990, p. 334)

15–18. **Sixth Annual IEEE Symposium on Logic in Computer Science**, Amsterdam, The Netherlands. (Sep. 1990, p. 937)

21–27. **Halbgruppentheorie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 744)

22–26. **Thirteenth IMACS World Congress on Computation and Applied Mathematics**, Trinity College, Dublin University, Dublin, Ireland. (Apr. 1990, p. 502)

* 28–August 2. **Conference on Symbolic Dynamics and its Applications**, Yale University, New Haven, CT. (Please note date change from Oct. 1990, p. 1138)

PURPOSE: The purpose of the conference is to honor Dr. Roy L. Adler for his many contributions to the subject.

28–August 3. **Gruppen und Geometrien**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 502)

August 1991

3–7. **Interamerican Conference on Mathematics Education**, Univ. of Miami, Coral Gables, FL. (Apr. 1990, p. 502)

4–10. **Effiziente Algorithmen**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 744)

5–8. **ICMI-China Regional Conference on Mathematics Education**, Beijing, China. (Jul./Aug. 1990, p. 744)

5–9. **Fourteenth International Symposium on Mathematical Programming**, Amsterdam, The Netherlands. (Jul./Aug. 1990, p. 745)

8–11. **Joint Mathematics Meetings**, University of Maine, Orono, ME. (including the summer meetings of the AMS, AWM, MAA, and PME)

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

11–17. **European Young Statisticians Meeting**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 745)

14–16. **Short Conference on Uniform Mathematics and Applications (International Conference on Quasi-Uniformities and Related Structures)**, Bern, Switzerland. (Sep. 1990, p. 937)

18–24. **The Navier-Stokes Equations: Theory and Numerical Methods**, Ober-

wolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 745)

18–24. **The Third Conference of the Canadian Number Theory Association**, Queen's University, Kingston, Ontario. (Sep. 1990, p. 938)

18–September 4. **Twenty-first Summer Ecole de Calcul des Probabilités**, Saint Flour, France. (Jul./Aug. 1990, p. 745)

19–22. **1991 Joint Statistical Meetings**, Atlanta, GA. (Mar. 1988, p. 466)

19–September 6. **College on Singularity Theory**, Trieste, Italy. (Sep. 1990, p. 938)

*21–23. **Thirteenth Boundary Element Method International Conference**, Tulsa, OK.

SPONSORS: Computational Mechanics Institute and Oklahoma State University.
CALL FOR PAPERS: Deadline for Abstracts: December 18, 1990; Papers are requested in any topics of direct relevance to Boundary Element Research.
INFORMATION: S. Gipson, School of Civil Engineering, 314 Engineering South, Oklahoma State Univ., Stillwater, OK 74078; 405-744-5714; FAX: 405-744-5033.

21–25. **The International Conference on the Theory of Rings, Algebras, and Modules in Honor of A.I. Shirshov**, Barnaul, U.S.S.R. (Jul./Aug. 1990, p. 745)

25–31. **Klassifikation Komplex-Algebraischer Varietäten**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 745)

*25–31. **Conference on Classifying Spaces of Compact Lie Groups and Finite Loop Spaces**, Göttingen University.

PROGRAM: The SFB Geometrie and Analysis of the Math Institute of Göttingen will host a conference thematically organized around the classifying spaces of compact Lie groups.
ORGANIZING COMMITTEE: G. Mislin, Ohio State Univ. and ETH, Zurich; L. Smith, Yale Univ. and Univ. Göttingen; C. Wilkerson, Purdue Univ.
INFORMATION: L. Smith, Dept. of Math., Yale Univ., P.O. Box 2155 Yale Station, New Haven, CT 06520; email: larry@lom1.math.yale.edu.

September 1991

1–7. **Topologie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 745)

4–10. **IMA Tutorial**, University of Minnesota, Minneapolis, MN. (Oct. 1990, p. 1139)

7–9. **International Workshop on Software for Automatic Control Systems**, Irkutsk, USSR. (Oct. 1990, p. 1139)

8–14. **Niedrigidimensionale Topologie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 745)

8–14. **Knoten und Verschlingungen**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 745)

9–27. **School on Dynamical Systems**, Trieste, Italy. (Sep. 1990, p. 938)

10–13. **IFAC/IMACS Symposium on Fault Detection, Supervision and Safety for Technical Processes-SAFEPROCESS '91**, Baden-Baden, Federal Republic of Germany. (Apr. 1990, p. 502)

11–13. **IFAC/IFIP/IMACS Symposium on Robot Control (SYROCO '91)**, Vienna, Austria. (Oct. 1990, p. 1140)

*11–14. **Fourth SIAM Conference on Applied Linear Algebra**, Univ. of Minnesota, Minneapolis, MN. (Please note date change from Apr. 1990, p. 502)

*13–15. **Representation Theory Conference**, University of Oregon, Eugene, OR.

PURPOSE: The conference is in honor of C.W. Curtis and will cover topics in the representation theory of finite groups of Lie type and associated algebraic groups.
INVITED SPEAKERS: J. Alperin, M. Broué, R. Carter, E. Cline, W. Feit, P. Fong, G. Lehrer, G. Lusztig, B. Parshall, I. MacDonald, R. Richardson, L. Scott, T. Shoji, L. Solomon, T. Springer, B. Srinivasan, R. Steinberg.
INFORMATION: Representation Theory Conference, Dept. of Math., Univ. of Oregon, Eugene, OR 97403.

15–20. **DMV-Jahrestagung 1991**, Bielefeld, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

15–21. **Geometrie der Banachräume**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

22–28. **Nonlinear and Random Vibrations**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

23–29. **Sixth Symposium on Classical Analysis**, Kazimierz Dolny, Poland. (Apr. 1990, p. 502)

24–27. **International Conference on Theoretical Aspects of Computer Software**, Tohoku Univ., Sendai, Japan. (Sep. 1990, p. 938)

25–27. **Ninth GAMM Conference on Numerical Methods in Fluid Mechanics**, Lausanne, Switzerland. (May/Jun. 1990, p. 613)

29–October 5. **Kombinatorik Geordneter Mengen**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

October 1991

6–12. **Arbeitsgemeinschaft mit Aktuellem Thema (wird in den Mitteilungen der DMV Heft 3/1991 bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

7–11. **Workshop on Stochastic and Deterministic Models**, Trieste, Italy. (Sep. 1990, p. 938)

12–13. **Eastern Section**, Temple University, Philadelphia, PA.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

13–19. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

14–18. **IMA Workshop on Sparse Matrix Computations: Graph Theory Issues and Algorithms**, University of Minnesota, Minneapolis, MN. (Oct. 1990, p. 1140)

*16–18. **SIAM Workshop on Micromechanics**, Leesburg, VA.

ORGANIZER: R.V. Kohn, Courant Institute of Mathematical Sciences, New York University.
INFORMATION: SIAM Conference Coordinator, Dept. CC0990, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; FAX: 215-386-7999; email: siamconfs@wharton.upenn.edu.

*21–26. **Third International Workshop-Conference on Evolution Equations, Control Theory, and Biomathematics**, Hansur-Lesse, Belgium.

SPONSORS: European Community (Science Plan, Project "Evolutionary Sys-

tems"), and the universities of Mons and Antwerp, Belgium, in cooperation with other European laboratories belonging to the above mentioned EC Project.
ORGANIZERS: Ph. Clement (Delft U., The Netherlands), G. Lumer (U. of Mons, Belgium), J. Van Casteren (U. Antwerp, Belgium).
CONFERENCE WORKSHOPS/LECTURERS: H. Amann (Zürich), Ph. Bénilan (Besancon), for the workshop on Nonlinear Parabolic Equations; G. Lumer (Mons), R. Nagel (Tübingen), W. Schappacher (Graz), for the workshop on Evolution Equations; G. Da Prato (Pisa), W. Desch (Graz), for the workshop on Control Theory; O. Diekmann (Amsterdam), K. Hadeler (Tübingen), for the workshop on Mathematical Biology. There will also be other invited participants/lecturers in the workshops. The workshops will be open as well for presentation of short communications.
INVITED GENERAL LECTURERS: W. Arendt (Besancon), M. Crandall (Santa Barbara), W. Jäger (Heidelberg), P. Malliavin (Paris), F. Neubrander (Baton Rouge), E. Sinestrari (Roma), W. von Wahl (Bayreuth).
INFORMATION: G. Lumer, 3rd International Conference on Evolution Equations, Inst. de Mathématique, Université de Mons, Place du Parc 20, B-7000 Mons, Belgium. It is planned to publish proceedings for this workshop-conference similar to those for the earlier (1987, 1989) conferences in Trieste and Delft.

November 1991

3–9. **Mengenlehre**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

* 4–8. **Second SIAM Conference on Geometric Design**, Tempe, AZ.

ORGANIZER: R.E. Barnhill, Arizona State University.
CALL FOR PAPERS: Abstract deadline: May 6, 1991.
INFORMATION: SIAM Conference Coordinator, Dept. CC0990, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; FAX: 215-386-7999; email: siamconfs@wharton.upenn.edu.

9–10. **Western Sectional Meeting**, University of California, Santa Barbara.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

11–15. **IMA Workshop on Combinatorial and Graph-Theoretic Problems in Linear Algebra**, University of Minnesota, Minneapolis, MN. (Oct. 1990, p. 1140)

17–23. **Singularitäten der Kontinuumsmechanik: Numerische und Konstruktive Methoden zu Ihrer Behandlung**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

18–22. **Supercomputing '91**, Albuquerque, NM. (Jan. 1990, p. 62)

20–26. **C^*-Algebren**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

24–30. **Numerische Methoden der Approximationstheorie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1990, p. 746)

25–26. **Central Section**, North Dakota State University, Fargo, ND.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

December 1991

* 2–9. **SIAM Conference on Combustion**, St. Petersburg, FL.

ORGANIZER: J.D. Buckmaster, University of Illinois, Urbana.

CALL FOR PAPERS: Abstract deadline: June 24, 1991.
INFORMATION: SIAM Conference Coordinator, Dept. CC0990, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; FAX: 215-386-7999; email: siamconfs@wharton.upenn.edu.

June 1992

* 12–14. **Canadian Mathematical Society Summer Meeting**, York University, North York, Ontario, Canada.

PROGRAM COMMITTEE: E. Campbell (Chair.), R. Buchweitz, P. Hoffman, N. Madras, J. Stephrans.
INFORMATION: S. Kochman, Dept. of Math., York Univ., 4700 Keele St., North York, Ontario, M3J 1P3; 416-736-5250;
email: kochman@nexus.yorku.ca.

August 1992

* 19–26. **World Congress of Nonlinear Analysts**, Melbourne, FL.

PROGRAM: There will be approximately 20 invited expository addresses covering recent developments in major areas of nonlinear analysis and about 120 invited lectures divided into the following six main sections: 1. nonlinear operators; 2. calculus of variations and optimization; control theory; and system analysis; 3. numerical and computational aspects; mathematical modelling; 4. dynamic systems; 5. stochastic analysis and applications; 6. real-world applications.
INFORMATION: V. Lakshmikantham, Chairman, GSAC, Florida Institute of Technology, Dept. of Applied Math., 150 West University Blvd., Melbourne, FL 32901-6988; 407-768-8000 ext. 8091 or 7412; FAX: 407-984-8461.

New AMS Publications

OPERATIONS ANALYSIS IN THE UNITED STATES ARMY EIGHTH AIR FORCE IN WORLD WAR II

Charles W. McArthur

(History of Mathematics, Volume 4)

Operations research grew out of the application of the scientific method to certain problems of war during World War II. This book tells the story of how operations research became an important activity in the Eighth Air Force.

A small group of civilians, which began with four scientists and two lawyers, comprised the Operations Research Section, an advisory body attached to the Headquarters of the Eighth Bomber Command. During the course of the war in Europe, over forty operations analysts worked with the Eighth Air Force. By the end of 1943, the section had established itself as the authority on measurement and analysis of bombing accuracy, loss and battle damage, aerial gunnery, and general mission analysis, such as fuel consumption. In their dealings with visual bombing, radar, radio countermeasures, V-weapons, and flak analysis, these experts discovered that the air force could do a much better job with fewer bombs by using bombs of the correct size with the correct fuse settings. In addition, the section advised the commanding generals on major aspects of the strategic bombing campaign in Europe, including bombardment of German lines and support of Allied ground troops in the Normandy invasion, the isolation of Normandy by aerial destruction, and the demolition of the German synthetic oil industry.

The author emphasizes the people involved in these historical events, rather than the technical matters with which they dealt. Focusing on a time of great importance in the history of this century, the book reveals the vital role this group of civilian scientists played in the defeat of Germany.

Contents

The beginning of operations analysis in the Eighth Air Force; *The pioneer operations research section organizes, October 1942–December 1942*; *The operational research section of the Eighth Bomber Command continues to organize (January 1943–June 1943)*; *Operations research in the Eighth Bomber Command, June–December 1943*; *The operational research section of the Eighth Fighter Command, January 1944–6 June 1944*; *The operations research section of the Eighth Air Force, January 1944–6 June 1944*; *Operations analysis in the Eighth Air Force, 6 June 1944–July 1944*; *Operations analysis in the Eighth Air Force, August–December 1944, Part* I; *Operations analysis in the Eighth Air Force, August–December 1944, Part* II; *Operations analysis in the United States Army Eighth Air Force in World War* II, *August–December 1944, Part* III; *Operations analysis in the Eighth Air Force, August–December 1944, Part* IV; *Operations analysis in the Eighth Air Force, the last four months of combat operations*.

BIOGRAPHY

Charles Wilson McArthur was born in New Orleans on November 4, 1921. He received his Ph.D. in mathematics in 1954 from Tulane University. His three years with the United States Air Force (1943-45) were spent in part as a bombardier. He taught at the University of Maryland (1952-53), Alabama Polytechnic Institute, Auburn (1953-56), and Florida State University (1956-64), where he advanced to the rank of professor in 1964 and retired in 1986. He was chair of the Department of Mathematics at F.S.U. from 1974 to 1980 and was named Professor Emeritus in 1987.

McArthur was chair of the Florida Section of the Mathematical Association of America from 1971 to 1972, and section representative on the MAA Board of Governors from 1977 to 1980. In 1987, he received an award from the Florida Section for outstanding contributions to mathematics and the mathematical community.

McArthur has published twenty-one papers, two in applied mathematics and the remainder in functional analysis. He was the major professor of the first doctoral student in mathematics at F.S.U., as well as sixteen other students who earned their Ph.D. degrees under his direction.

1980 *Mathematics Subject Classification*: 01A60
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ROBOTICS
R. W. Brockett, Editor
(Proceedings of Symposia in Applied Mathematics, Volume 41)

The central problem of robotics is the analysis and replication of patterns of movement required to accomplish useful tasks. Physicists have found that deeper examination of the physical world often reveals inadequacies in the vocabulary and mathematics used to describe it; in much the same way, roboticists have found it quite awkward to give precise, succinct descriptions of effective movements using the syntax and semantics in common use. What is needed to produce general purpose robots is a more expressive means for discussing movement. This volume focuses on some of the ways that mathematics can be used to address problems in this area.

Focusing on some of the important mathematical questions arising in the field of robotics, this book conveys a sense for the effectiveness of mathematics in capturing the essence of robotics problems. In addition, the book will make readers aware of the way in which computer control interacts with geometry. The first four papers deal with kinematics and control, relying on realistic models for kinematic processes. The last two papers have more of the flavor of computer science and are concerned with the symbolic descriptions of motion, including the treatment of uncertainty.

The book is directed toward mathematically literate readers interested in finding out about the questions that arise in robotics and how mathematics can help answer them. A mathematical background at the level of an undergraduate degree in mathematics and some knowledge of basic mechanics is assumed.

Contents

R. W. Brockett, *Some mathematical aspects of robotics*; **Madhusudan Raghavan**, *Manipulator kinematics*; **J. Baillieul and D. P. Martin**, *Resolution of kinematic redundancy*; **Richard M. Murray and S. Shankar Sastry**, *Grasping and manipulation using multifingered robot hands*; **Bruce R. Donald**, *Planning and executing robot assembly strategies in the presence of uncertainty*; **R. W. Brockett**, *Formal languages for motion description and map making*.

1980 *Mathematics Subject Classifications*: 70B15, 53A17, 68G05, 93-02, 68-02
ISBN 0-8218-0163-5, LC 90-1220, ISSN 0160-7634
196 pages (hardcover), November 1990
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STATISTICAL ANALYSIS OF MEASUREMENT ERROR MODELS AND APPLICATIONS
Philip J. Brown and Wayne A. Fuller, Editors
(Contemporary Mathematics, Volume 112)

Measurement error models describe functional relationships among variables observed, subject to random errors of measurement. Examples include linear and nonlinear errors-in-variables regression models, calibration and inverse regression models, factor analysis models, latent structure models, and simultaneous equations models. Such models are used in a wide variety of areas, including medicine, the life sciences, econometrics, chemometrics, geology, sample surveys, and time series. Although the problem of estimating the parameters of such models exists in most scientific fields, there is a need for more sources that treat measurement error models as an area of statistical methodology. This volume is designed to address that need.

This book contains the proceedings of an AMS-IMS-SIAM Joint Summer Research Conference in the Mathematical Sciences on Statistical Analysis of Measurement Error Models and Applications. The conference was held at Humboldt State University in Arcata, California in June 1989. The papers in this volume fall into four broad groups. The first group treats general aspects of the measurement problem and features a discussion of the history of measurement error models. The second group focuses on inference for the nonlinear measurement error model, an active area of research which generated considerable interest at the conference. The third group of papers examines computational aspects of estimation, while the final set studies estimators possessing robustness properties against deviations from common model assumptions.

Contents

GENERAL PROBLEMS: **Peter Sprent**, *Some history of functional and structural relationships*; **Alice S. Whittemore**, *Errors-in-variables regression problems in epidemiology*; **Hans Schneeweiss**, *Models with latent variables: LISREL versus PLS*; **Wayne A. Fuller**, *Prediction of true values for the measurement error model*; **Stephen M. Miller**, *Analysis of residuals from measurement error models*; **John L. Eltinge**, *Errors-in-variables estimation in the presence of serially correlated observations*; **NONLINEAR MODELS**: **Leon Jay Gleser**, *Improvements of the naive approach to estimation in nonlinear errors-in-variables regression models*; **Leonard A. Stefanski and Raymond J. Carroll**, *Structural logistic regression measurement error models*; **Daniel W. Schafer**, *Measurement error model estimation using iteratively weighted least squares*; **Philip J. Brown and Samuel D. Oman**, *Problematic points in nonlinear calibration*; **Yasuo Amemiya**, *Instrumental variable estimation of the nonlinear measurement error model*; **Daniel J. Schnell**, *A likelihood ratio test for error covariance specification in nonlinear measurement error models*; **Cliff J. Spiegelman**, *Plotting techniques for errors in variables problems*; **COMPUTATIONAL ASPECTS**: **G. W. Stewart**, *Perturbation theory and least squares with errors in the variables*; **Paul T. Boggs and Janet E. Rogers**, *Orthogonal distance regression*; **Nicholas J. Higham**, *Computing error bounds for regression problems*; **ROBUST PROCEDURES**: **Michael W. Browne**, *Asymptotic robustness of normal theory methods for the analysis of latent curves*; **Chi-Lun Cheng and John W. Van Ness**, *Bounded influence errors-in-variables regression*; **Victor J. Yohai and Ruben H. Zamar**, *Bounded influence estimation in the errors-in-variables model*.

1980 *Mathematics Subject Classifications*: 62-06; 62J99
ISBN 0-8218-5117-9, LC 90-44278, ISSN 0271-4132
248 pages (softcover), November 1990
Individual member $32, List price $53,
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REDUCTION, SYMMETRY, AND PHASES IN MECHANICS

J. Marsden, R. Montgomery, and T. Ratiu
(Memoirs of the AMS, Number 436)

Aimed at graduate students and researchers in geometric mechanics, this book establishes a basic link between phases and symmetry methods in mechanics. The authors show that geometric phase and holonomy phenomena in mechanics are instances of the reconstruction procedure for mechanical systems with symmetry. They systematically exploit this point of view for fixed systems (for example, with controls on the internal, or reduced, variables) and for slowly moving systems in an adiabatic context. For the latter, they obtain the phases as the holonomy of a connection which synthesizes the Cartan connection for moving mechanical systems with the Hannay-Berry connection for integrable systems. This synthesis allows one to treat, in a natural way, examples like the ball in the slowly rotating hoop and non-integrable mechanical systems. Applications to coupled rigid bodies, the Foucault pendulum, and other mechanical systems are given.

Contents

Some Examples; *Reconstruction of dynamics for Hamiltonian systems*; *Reconstruction of dynamics for Lagrangian systems*; *Ehresmann connections and holonomy*; *Reconstruction phases*; *Averaging connections*; *Existence, uniqueness and curvature of the Hannay-Berry connections*; *The Hannay-Berry connection in the presence of additional symmetry*; *The Hannay-Berry connection on level sets of the momentum map*; *Case I: Bundles of symplectic manifolds with the canonical connection; integrable systems*; *Case II: Cartan connections; moving systems*; *The Cartan angles; the ball in the hoop and the Foucault pendulum*; *Induced connections on the tower of bundles*; *The Hannay-Berry connection for general systems.*

1980 *Mathematics Subject Classifications*: 58F, 70H
ISBN 0-8218-2498-8, LC 90-1143, ISSN 0065-9266
109 pages (softcover), November 1990
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REGULAR *b*-GROUPS, DEGENERATING RIEMANN SURFACES, AND SPECTRAL THEORY

Dennis A. Hejhal
(Memoirs of the AMS, Number 437)

This book is concerned with the spectral theory of the hyperbolic Laplacian as the underlying Riemann surface is "pinched down" to a surface with nodes. The author approaches this problem from the standpoint of regular b-groups and the Selberg trace formula. Ideas of this kind have recently become useful in connection with string theory. Perhaps the book's most significant contribution lies in the theorems dealing with the limiting behavior of Green's function, the Selberg zeta function, and the spectral distribution function. Providing readers with an up-to-date understanding of how the spectrum of the Laplacian behaves under pinching deformations, the book is directed at students and researchers in automorphic forms, trace formulas, Kleinian groups, or string theory.

Contents

Riemann surfaces with nodes and regular b-groups; *The space $\mathcal{M}_g$*; *Convergence of Green's functions (part one)*; *Collars and nodal neighborhoods*; *An apriori bound for prime geodesics*; *Convergence of Green's functions (part two)*; *Continuity properties of small eigenvalues*; *Asymptotic properties of the Selberg zeta function*; *An analog of Weyl's Law.*

1980 *Mathematics Subject Classifications*: 10D15, 30F35, 30F40, 32G15, 35P20
ISBN 0-8218-2499-6, LC 90-1171, ISSN 0065-9266
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THÉORIE HOMOTOPIQUE DES FORMES DIFFÉRENTIELLES (D'APRÈS D. SULLIVAN) Seconde Édition Revue et Augmentée

D. Lehmann
(Astérisque, Number 45)

Un théorème bien connu de de Rham exprime que l'algèbre $\Omega_{DR}(X)$ des formes différentielles sur une variété différentiable X permet de calculer la cohomologie réelle de X. L'une des conséquences de la théorie de Sullivan est que cette algèbre fournit bien d'autres informations sur la topologie de X; par exemple, si X est simplement connexe, elle détermine entièrement le "type d'homotopie réel" de X (i.e. les groupes $\pi_n(X) \otimes \mathbb{R}$ et les invariants de Postnikov réels), résultat qui se généralise au cas des espaces nilpotents (c'est-à-dire dont le groupe fondamental est nilpotent, et opère de façon nilpotente sur les groupes d'homotopie d'ordre supérieur).

Contents

Rappels de topologie: *Espaces d'Eilenberg-Mac Lane*; *Décomposition de Postnikov*; *Espaces nilpotents*; *Localisation des espaces nilpotents*; **Algèbres différentielles graduées commutatives**: *La catégorie $k - ADG_{(c)}$*; *Extensions principales et algèbres minimales*; *Modèle minimal d'une $k-ADG_{(c)}$ connexe*; **Formes différentielles simpliciales**: *Le probléme des cochaines commutatives*; *Construction de solutions au problème des cochaines commutatives*; *Transformations*; *Foncteur $F : (\mathcal{M} - ADG)_{\mathbb{Q}} \to T_{\mathbb{Q}}$*; **Transgression**: *Fibrations totalement transgressives*; *Application aux fibrations principales*; *Application aux espaces nilpotents. Théorème principal*; *Remarques sur l'équivalence de catégorie $T_{\mathbb{Q}} \leftrightarrow (\mathcal{M} - ADG)_{\mathbb{Q}}$*; **Quelques exemples et applications**: *Cas où l'algèbre de cohomologie est libre*; *Sphères S^{2N} de dimension paire*; *Espaces projectifs complexes $P^n(\mathbb{C})$*; *Cas des*

variétés différentiables; Fibrés principaux C^∞ et G – ADG; Espace classifiant d'un groupe nilpotent; Espaces fonctionnels; Modèle minimal d'une $ADG_{(c)}$ libre connexe et simplement connexe; Espaces formels.

1980 *Mathematics Subject Classifications*: 55, 58
ISSN 0303-1179
145 pages, November 1990
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Positive Definite Unimodular Lattices with Trivial Automorphism Groups

Etsuko Bannai • (Memoirs of the AMS, Number 429)

In this book, the author proves that there exists a lattice with trivial automorphism group in every genus of positive definite unimodular **Z**-lattices of rank m (with $m \geq 43$ for the odd unimodular case and $m \geq 144$ for the even unimodular case). Siegel's mass formulas for lattices (for both orthogonal and hermitian cases) are used in the proof. In addition, the author shows that, for those positive definite unimodular **Z**-lattices in the given genus and of rank m, the ratio of the mass of classes with nontrivial automorphisms to the mass of all classes approaches 0 very rapidly as m increases. The book is intended for researchers and advanced graduate students in the areas of number theory and quadratic forms.

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Algebraic Geometry for Scientists and Engineers

Shreeram S. Abhyankar

Mathematical Surveys and Monographs, Volume 35

This book, based on lectures presented in courses on algebraic geometry taught by the author at Purdue University, is intended for engineers and scientists (especially computer scientists), as well as graduate students and advanced undergraduates in mathematics. In addition to providing a concrete or algorithmic approach to algebraic geometry, the author also attempts to motivate and explain its link to more modern algebraic geometry based on abstract algebra. The book covers various topics in the theory of algebraic curves and surfaces, such as rational and polynomial parametrization, functions and differentials on a curve, branches and valuations, and resolution of singularities. The emphasis is on presenting heuristic ideas and suggestive arguments rather than formal proofs. Readers will gain new insight into the subject of algebraic geometry in a way that should increase appreciation of modern treatments of the subject, as well as enhance its utility in applications in science and industry.

1980 *Mathematics Subject Classifications*: 14
ISBN 0-8218-1535-0, LC 90-815, ISSN 0076-5376
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AMS Reports and Communications

The Summer Meeting in Columbus

The August 1990 Joint Mathematics Meetings, including the 93rd Summer Meeting of the AMS, the 69th Summer Meeting of the MAA and the celebration of the 75th anniversary of the founding of the MAA, the 1990 Summer Meetings of the Association for Women in Mathematics, and Pi Mu Epsilon, was held August 8–11 on the campus of The Ohio State University in Columbus, Ohio. There were 1299 registrants, including 795 members of the Society.

AMS-MAA Invited Address. Sponsored jointly by the American Mathematical Society and the Mathematical Association of America, SAUNDERS MAC LANE spoke on *Algebra as a means of understanding mathematics.* Professor Mac Lane was introduced by William Browder, President of the Society.

Progress in Mathematics Lectures. By invitation of the Committee to Select Progress in Mathematics Speakers, there were two 90-minute Progress in Mathematics Lectures: MICHAEL G. CRANDALL spoke on *Viscosity solutions of partial differential equations*, and JOHN W. MORGAN spoke on *A-trees and their applications.* The Progress in Mathematics Lecturers were introduced by William Browder, President of the Society.

Invited Addresses. By invitation of the Program Committee, there were two 50-minute Invited Addresses: MICHAEL E. TAYLOR spoke on *The role of microlocal analysis in PDE*, and JOSEPH CONLON spoke on *Statistical mechanics of Coulomb systems.* The speakers were introduced by Cathleen S. Morawetz and Jan Philip Solovej, respectively.

Special Sessions. By invitation of the same committee, there were six special sessions of selected twenty-minute papers. The topics of these sessions, and the names and affiliations of the organizers, were as follows:

Algebraic Geometry, GARY KENNEDY and SUSAN JANE COLLEY, Oberlin College.

Combinatorics, DIJEN RAY-CHAUDHURI, THOMAS A. DOWLING, and NEIL ROBERTSON, Ohio State University (Columbus).

Combinatorial Games, RICHARD K. GUY, University of Calgary, and RICHARD J. NOWAKOWSKI, Dalhousie University.

Dynamics of Biological Systems, ZITA M. DIVIS and DAVID TERMAN, Ohio State University (Columbus).

Group Theory, SURINDER K. SEHGAL and RONALD SOLOMON, Ohio State University (Columbus).

Ring Theory, S. K. JAIN, Ohio University, and S. TARIQ RIZVI, Ohio State University (Lima).

Contributed Papers. There were seven sessions for 10-minute contributed papers. The titles of these sessions, and the names of the individuals who served as co-chairs, are as follows:

Graph theory and combinatorics, WILLIAM C. ARLINGHAUS and GARY CHARTRAND.

Geometry, topology and infinite combinatorics, JAMES CAMACHO, JR. and GENE DOUGLAS JOHNSON.

Group theory, BEN BREWSTER and WOLFGANG KAPPE.

Algebraic number theory and multiplicative structures, DAVID W. JENSEN and LEROY F. MEYERS.

Function spaces, K. SUNDARESAN and GREGORY B. PASSTY.

Numerical methods and mathematical modeling, SANDRA L. ARLINGHAUS and WILLIAM A. JONES, JR.

Differential and integral equations, M. N. ISLAM and JOHN JONES, JR.

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Miscellaneous

Personals

Stephen H. Crandall, Ford Professor of Engineering and director of the Acoustics and Vibration Laboratory at the Massachusetts Institute of Technology, will receive the Timoshenko Medal of the American Society of Mechanical Engineers (ASME) during its winter meeting in November. The medal recognizes distinguished contributions to the field of applied mechanics. Dr. Crandall is receiving it for "enduring contributions to research in dynamics of mechanical systems and for the pioneering work in random vibrations".

Roger Grimshaw, of the University of New South Wales, was elected to Fellowship of the Australian Academy of Science at its 39th Annual General Meeting held in Canberra on April 19.

Seok-Jin Kang, currently a research instructor at North Carolina State University, was named a Prize Teaching Fellow at Yale University in 1989.

Michel L. Lapidus, of the University of Georgia, has accepted a new position as Full Professor of Mathematics at the University of California, Riverside.

John Loxton, of Macquarie University, was awarded the Medal of the Royal Society of New South Wales. The award is for contributions to the advancement of science, including administration and organization of scientific endeavour, and for services to the Society.

John F. Price, of the University of New South Wales, has been appointed Professor of Mathematics and Chairperson of the department at Maharishi International University.

Ian F. Putnam, of Dalhousie University, has won the 1990 Israel Halperin Prize for his work on dynamical systems and C*-algebras.

Roger Richardson, of Australian National University, was elected to Fellowship of the Australian Academy of Science at its 39th Annual General Meeting held in Canberra on April 19.

Christina M. Wohlert, of Savannah, Georgia, graduated valedictorian of Armstrong State College's class of 1990.

Deaths

Ralph G. Archibald, Professor Emeritus of the University of Chicago, died on April 25, 1990 at the age of 88. He was a member of the Society for 63 years.

Isadore I. Hirschman, retired professor from Washington University, died on June 10, 1990 at the age of 67. He was a member of the Society for many years.

James H. Moran, of Spicewood, Texas, died on August 7, 1990 at the age of 65. He was a member of the Society for 30 years.

Edwin J. Purcell, Professor Emeritus of the University of Arizona, died on September 25, 1989 at the age of 88. He was a member of the Society for 59 years.

Dudley E. South, Professor Emeritus of Eckerd College, died on July 30, 1990 a the age of 90. He was a member of the Society for 46 years.

Robert Wanner Wagner, Professor Emeritus of the University of Massachusetts at Amherst, died on February 22, 1990 at the age of 76. He was a member of the Society for 54 years.

Visiting Mathematicians

Supplementary List

Mathematicians visitng other institutions during the 1989-1990 and 1990-1991 academic years have been listed in recent issues of *Notices*: October 1990, p. 1148; September 1990, p. 959; July/August 1990, p. 758; May/June 1990, p. 621; April 1990, p. 508; March 1990, p. 342.

Barry E. Johnson (United Kingdom), University of California, Los Angeles, Banach Algebras, 8/90-3/91 and University of California, Santa Barbara, 3/91-6/91.

Yukio Kobayashi (Japan), University of Arkansas, Semigroups, 9/90-8/91.

Phillip E. Parker (U.S.A.), Universidade de Santiago de Compostela, Differential Geometry, Theoretical Physics, and Number Theory, 2/91-5/91.

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Intended primarily for those whose first language is English, this dictionary will prove a useful tool for researchers, editors, and translators working with Russian mathematical literature.

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SITUATIONS WANTED ADVERTISEMENTS from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. and Canada for further information.

SEND AD AND CHECK TO: Advertising Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Individuals are requested to pay in advance, institutions are not required to do so. AMS FAX 401-331-3842.

POSITIONS AVAILABLE

ALABAMA

AUBURN UNIVERSITY
Department of Algebra, Combinatorics and Analysis

Applicants in combinatorics are sought for a tenure-track appointment at the rank of assistant professor expected to be made beginning September 1991. Preference given to candidates in discrete optimization, coding theory, cryptology, extremal set theory, or association schemes.

Some temporary one-year appointments at the rank of assistant professor are also expected beginning September 1991. Preference given to applicants in differential equations. Those in algebra, analysis, combinatorics, linear algebra or probability considered. Research interests compatible with current faculty.

Excellence required in both teaching and research for all positions. Send resume and arrange for at least three letters of recommendation to be sent to James Wall, 120 Math Annex, Auburn University, AL 36849-5307. Minorities and women are encouraged to apply. Auburn University is an Equal Opportunity/Affirmative Action Employer.

AUBURN UNIVERSITY
Division of Mathematics
Department of Foundations, Analysis and Topology

We anticipate visiting positions at various ranks and possibly a tenure-track position, all beginning Fall 1991. Primary consideration will be given to mathematicians whose research is compatible with that of the current faculty. A Ph.D. in mathematics or equivalent is required for the position. Closing date for applications is January 13, 1991, or until the positions are filled.

Applicants should submit a vita and have three letters of reference sent to George Kozlowski, Head; Department of Foundations, Analysis and Topology; Auburn University, AL 36849-5310.

Auburn University is an equal opportunity, affirmative action employer. Women and minority candidates are encouraged to apply.

THE UNIVERSITY OF ALABAMA
Math Faculty Positions

The department expects to fill two, or possibly more, tenure-track positions at the rank of Assistant Professor or higher beginning August 16, 1991. Areas for specific consideration include mathematical statistics and topology. Outstanding candidates in other areas may also be considered. Applicants for Assistant Professor should have or expect to have a Ph.D. or the equivalent by August 16, 1991. Excellence in both teaching and research is required. Applications for visiting positions may also be considered. Women and minorities are particularly encouraged to apply. Send a curriculum vitae, reprints and/or preprints, and at least three letters of recommendation to: Search Committee, Department of Mathematics, The University of Alabama, Box 870350, Tuscaloosa, AL 35487-0350. UA is an AA/EOE.

ARIZONA

NORTHERN ARIZONA UNIVERSITY
Flagstaff, Arizona

The Department of Mathematics announces tenure-track openings in mathematics, mathematics education and statistics for Fall 1991.

Ordinary Differential Equations. Assistant Professor with specialty in the geometric theory of dynamical systems supporting work of our existing special research focus. Current research of this group concentrates on planar systems with polynomial right hand sides and bifurcation theory.

Mathematics Education. (1) Professor with commensurate record of research, leadership at the university and regional or national levels, and experience with teacher education programs. (2) Assistant Professor. Specialty in the use of technology in instruction is preferred, but all areas will be considered.

Statistics. Assistant Professor with strong theoretical background, interest in applied statistics and intramural consulting, and the ability to contribute to the development of an interactive research group.

Each requires a doctorate, demonstrated potential for a productive, quality research program, and substantial evidence of high quality teaching.

Flagstaff is located in the cool pine forests of Northern Arizona, near high mountains, the Grand Canyon and numerous other natural attractions. NAU has an on-campus enrollment of approximately 14,000. The Department of 34 faculty offers bachelor's and master's degree programs.

Send vita and direct three letters of reference to: Screening Committee, Department of Mathematics, PO Box 5717, Northern Arizona University, Flagstaff, AZ 86011. The searches will remain open until the positions are filled; however, the Screening Committee will begin reviewing applications on January 7, 1991. Northern Arizona University is an Equal Opportunity/Affirmative Action Institu-

tion. Women and minorities are encouraged to apply

UNIVERSITY OF ARIZONA
Department of Mathematics
Tucson, Arizona 85721

The Mathematics Department at the University of Arizona is happy to announce several positions which will be available beginning Fall 1991.

Tenure-track positions. Excellent research record or potential, strong commitment to teaching required. Fields should complement but not duplicate existing department research strengths in algebra, arithmetic geometry, computational science, differential equations, dynamical systems, fluid mechanics, differential geometry, mathematical physics, nonlinear analysis, nonlinear science, number theory, and probability.

Postdoctoral Fellowships (Research Associate). Applicants with strengths in all areas compatible with department interests, but specifically geometry and mathematical physics are encouraged to respond. In addition, special Center of Excellence Awards in nonlinear optics and fluid mechanics are available.

The Mathematics Department will also have several **visiting positions** for next year.

We encourage early application. **Deadline** date will be **February 1, 1991** or whenever positions are filled. *Women and minority applicants are especially welcome*. Send applications to:

Alan C. Newell, Head
Department of Mathematics
University of Arizona
Tucson, Arizona 87521, USA

The University of Arizona is an Affirmative Action/Equal Opportunity Employer.

CALIFORNIA

CALIFORNIA STATE POLYTECHNIC UNIVERSITY

Tenure-track position in Mathematics at the assistant professor level, salary dependent upon qualifications, Doctorate in Mathematics or equivalent degree. Evidence of potential for excellent teaching and scholarly research required. Preference for mathematical modeling, history of mathematics, algebraic geometry or mathematical physics. Application, resume, copy of transcripts and three current letters of reference to be postmarked by 1/31/91. For additional information or to apply contact: Search Committee, Mathematics Department, California State Polytechnic University, 3801 W. Temple Ave., Pomona, CA 91768-4033. (714)869-3467. EOE/AA.

CALIFORNIA STATE UNIVERSITY, HAYWARD
Dept. of Mathematics & Computer Science

Department invites applications for entry level tenure-track Assistant Professor position in mathematics beginning Fall 91. Applicants should hold Ph.D. degree in mathematics, be committed to excellence in teaching, exhibit competence and potential to engage in professional activities including research and publication. All areas of specialization will be considered, including mathematics education. The department enrolls more than 700 majors in its four degree programs: B.S. in Mathematics, B.S. in Computer Science and M.S. in both disciplines. Please send resume and three references to Mathematics Faculty Search Committee, Dept. of Mathematics & Computer Science, California State University, Hayward, Hayward, CA 94542-3092. Applications received by Jan. 1, 1991 will be assured full consideration. Applications will be accepted until position is filled. Position #91-92 MATH-TT-1. CSUH is an Equal Opportunity/Affirmative Action Employer.

CALIFORNIA STATE UNIVERSITY AT LOS ANGELES

The Department of Mathematics and Computer Science invites applications for two tenure track positions at the assistant or associate level for a starting date of late June or September 1991. Our main area's of interest are Geometry, Combinatorics and Math Education. Ph.D. required (ABD in Math Education will be considered). Considerations will start February 1, 1991. Send inquiries to:

Marshall Cates, Chair
Department of Mathematics and Computer Science
California State University at Los Angeles
5151 State University Drive
Los Angeles, CA 90032

An Equal Opportunity, Affirmative Action, Handicapped Title IX Employer.

CALIFORNIA STATE UNIVERSITY, LONG BEACH

Tenure-track position Statistics, begin Fall 1991: Requires Ph.D. Math, Applied Math or Statistics; strong coursework math, research interests stat; evidence effective teaching and strong research potential; knowledge actuarial math desirable. Teach 3-4 classes per semester undergrad math and stat, MA-level stat; research in specialty. Asst. or Assoc. Prof. preferred. Send resume, transcripts, 3 reference letters to Samuel G. Councilman, Chair, Math Dept., CSU Long Beach, CA 90840-4502. Position open until filled, selection begins 12/1/90. CSULB is an Equal Opportunity/Affirmative Action/Title IX Employer.

CALIFORNIA STATE UNIVERSITY, SACRAMENTO

One tenure-track position (Asst. or Assoc. Prof.) for Fall 1991, at a step appropriate to the applicant's experience. Must have Ph.D. in Math or Statistics by Sept. 1, 1991. Salary range begins at $33,192. Applicants should be committed to excellence in teaching (12 units/semester) and must have some background and a willingness to work in the area of elementary and secondary teacher preparation. Send vita, graduate transcripts, and three letters of rec. (at least one commenting on teaching ability), by 1/31/91, to Hiring Committee, Math and Stat Dept., Sacramento, CA 95819-6051. The dept. is committed to improving the diversity of its faculty and encourages qualified women, underrepresented ethnic minorities, disabled individuals, and Vietnam-era veterans to apply. AA/EOE.

CALIFORNIA STATE UNIVERSITY SAN BERNARDINO
Department of Mathematics

Applications are being accepted for the position of Assistant Professor or Associate Professor (tenure-track); a Ph.D. in mathematics education with at least a bachelor's degree in mathematics is required. Successful candidates will be expected to teach twelve hours per week, participate in scholarly activities, and help implement a new MAT program. Current salary range is $30,276-$52,896 dependent upon qualifications and experience. Applicants should submit a letter of application, vita, three letters of recommendation and all transcripts. Applications received after February 1, 1991, cannot be guaranteed consideration. Materials should be sent to:

Dr. John Sarli
Chair, Department of Mathematics
California State University
5500 University Parkway
San Bernardino, California 92407

AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION, SECTION 504, TITLE IX EMPLOYER

POMONA COLLEGE
Claremont, CA

Pomona College seeks to hire a tenure-track Assistant Professor of Mathematics, preferably with postdoctoral experience. Excellent candidates from all fields of mathematics will be seriously considered, but preference will be given to applied mathematicians. Pomona College, a highly selective liberal arts college with intellectually gifted students, is one of the Claremont Colleges, which together provide an active professional community of over 30 mathematicians, an excellent research library, weekly Mathematics Colloquia, research seminars, and clinics in applied mathematics. We are looking for someone who can continue Pomona's tradition of excellent and innovative teaching and who will actively participate in the mathematical life of the Claremont Colleges.

Applications are to be sent to: The Search Committee, Department of Mathematics, Pomona College, Claremont, CA 91711-6348. Applications received by January 31, 1991, will be given full consideration. Applications must include a vita and letters of recommendation, including letters evaluating teaching, graduate school transcripts, and a description, written for the non-specialist, of research accomplishments and plans. Please let us know if you will be attending the January AMS meeting in San Francisco.

Pomona College is an Affirmative Action/Equal Opportunity Employer and encourages applications from minority candidates and women.

STANFORD UNIVERSITY
Department of Mathematics

Assistant Professorships in honor of Gabor Szegö. The department expects to make three or more appointments in 1991-92 for a term of two years. Applicants are expected to show outstanding promise in research and clear evidence of achievement. They should have received the Ph.D. prior to the start of the appointment but not before 1989. Stanford is committed to excellence in teaching, and applicants should count this as one of their goals. The teaching load consists of four 3-hour quarterly courses, and may include graduate courses. The nine-month salary for 1991-1992 will be at least $33,000. Candidates should send a letter of application with a curriculum vitae, a list of publications and information concerning teaching experience, and should arrange to have three letters of recommendation sent to Prof. Solomon Feferman, Chairman, Department of Mathematics, Stanford University, Stanford, CA 94305-2125, by January 1, 1991. Stanford is an Affirmative Action/Equal Opportunity Employer, and welcomes applications from women and minorities.

STANFORD UNIVERSITY
Department of Mathematics

The department expects to make one or more tenure-track or tenured appointments beginning September 1991 among the following fields: (1) analysis, (2) geometry or topology, (3) algebra, number theory, or logic, (4) applied mathematics or probability; in the last case there are also possibilities for joint appointments with other departments. At the tenured level, preference will go to individuals in the early years of their ranks, though a more senior appointment may be possible for an extremely well-qualified individual.

Candidates should send a letter of application and a curriculum vitae with a list of publications, and arrange to have three letters of recommendation and some evidence of commitment to excellence in teaching sent to Prof. Solomon Feferman, Chairman, Department of Mathematics, Stanford University, Stanford, CA 94305-2125, by January 1, 1991.

Stanford is an Equal Opportunity/Affirmative Action Employer, and welcomes applications from women and minorities.

UNIVERSITY OF CALIFORNIA, BERKELEY
Department of Statistics

Pending final budgetary approval, applications are invited for several special Neyman Visiting Assistant Professor positions, beginning Fall 1991 or Spring 1992. The appointment is of two-year duration (but can be shorter by mutual agreement) and is not renewable. Applicants should have exhibited exceptional research potential in any of the following areas: Theoretical or applied statistics, computational statistics, probability theory, applied probability. Appointees will be expected to teach as well as carry out a vigorous program of research. Send applications or inquiries (including resume and names of three references) by January 31, 1991 to: T. P. Speed, Chair, Department of Statistics, University of California, Berkeley, California 94720. The University of California is an Equal Opportunity, Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
AT BERKELEY
Department of Mathematics
Berkeley, CA 94720
TENURED POSITION

We invite applications for one or more positions effective July 1, 1991, at tenure level (Associate or full Professor), subject to budgetary approval, in the areas of algebra, analysis, applied mathematics, foundations, or geometry and topology. Demonstrated leadership in research is expected of applicants. Applicants should send a curriculum vitae, list of publications, a few selected reprints or preprints, and the names of three references to The Vice Chair for Faculty Affairs at the above address. We should receive this material no later than January 15, 1991. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
AT BERKELEY
Department of Mathematics
Berkeley, CA 94720
ASSISTANT PROFESSORSHIPS

We invite applications for one or more positions effective July 1, 1991, at the tenure-track Assistant Professor level, subject to budgetary approval, in the areas of algebra, analysis, applied mathematics, foundations, or geometry and topology. Applicants are expected to have demonstrated outstanding research potential, normally including major contributions beyond the doctoral dissertation. Applicants should send a resume, and reprints or preprints, and/or dissertation abstract, and ask three people to send letters of recommendation to The Vice Chair for Faculty Affairs at the above address. We should receive this material no later than January 15, 1991. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
AT BERKELEY
Department of Mathematics
Berkeley, CA 94720
CHARLES B. MORREY, JR.
ASSISTANT PROFESSORSHIPS

We invite applications for these special two-year (non-tenure-track) positions effective July 1, 1991. Applicants should have a recent Ph.D. in the areas of algebra, analysis, applied mathematics, foundations, or geometry and topology, and should have demonstrated superior research potential. Applicants should send a resume, and reprints, preprints and/or dissertation abstract, and ask three people to send letters of recommendation to The Vice Chair for Faculty Affairs at the above address. We should receive this material no later than January 15, 1991. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
AT BERKELEY
Department of Mathematics
Berkeley, CA 94720
TEMPORARY POSTDOCTORAL POSITIONS

Several temporary positions beginning in Fall 1991 are anticipated for new and recent Ph.D.'s of any age, in the areas of algebra, analysis, applied mathematics, foundations, or geometry and topology. The terms of these appointments may range from one to three years. Applicants for NSF or other postdoctoral fellowships are encouraged to apply for these positions; combined teaching/research appointments may be made for up to three years. Mathematicians whose research interests are close to those of regular department members will be given some preference. Applicants should send a resume, and reprints, preprints, and/or dissertation abstract, and ask three people to send letters of recommendation to the Vice Chair for Faculty Affairs at the above address. We should receive this material no later than January 15, 1991. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA, DAVIS
Faculty Positions in Mathematics

Applications are invited for three or more anticipated tenure-track positions in the Department of Mathematics, University of California, Davis, effective July 1, 1991. These positions are contingent on budgetary approval. Appointments will be made at Assistant Professor level commensurate with qualifications. Qualifications include a Ph.D. and great promise in teaching and research. Duties include undergraduate and graduate teaching and mathematical research.

We are primarily interested in applicants in one or more of the following areas. Applicants should indicate in which area(s) they are applying.

1. Mathematical Biology
2. Stochastic Analysis and Stochastic PDEs
3. Elliptic PDEs and Functional Analysis
4. Non-Linear Dynamics
5. Applied Analysis

To receive full consideration, applications should be received by *December 15, 1990*. Applications will be accepted until January 31, 1991, if the positions are not filled early. An application consists of a curriculum vitae, list of publications, and at least three letters of reference sent to

Chair of Search Committee
Department of Mathematics
University of California
Davis, California 95616-8633

The College of Letters and Science at UC Davis is committed to building a more diverse faculty and student body as it responds to the changing population and educational needs of California and the nation. As a consequence, we are especially interested in attracting persons from groups currently underrepresented on the campus. Our commitment demands that, irrespective of age and/or sexual preference, we pay special attention to applications from women, persons of color and persons with disabilities.

UNIVERSITY OF CALIFORNIA, IRVINE
Department of Mathematics
Irvine, CA 92717

The University of California at Irvine has made a significant commitment for the development of the mathematics department. A number of faculty appointments will be made over the next few years. These include:

1. At least five full time positions at any of the tenured professorial levels. The Department is particularly interested in areas of Algebra, Analysis, Applied Mathematics, Geometry, Mathematical Physics, Numerical Analysis-Scientific Computing, Probability, Statistics and Topology. Selection will be based on research experience and teaching ability.

2. At least one full time tenure-track Assistant Professor position. Candidates must have a Ph.D. and a research record either in Mathematical Physics or Differential Geometry.

Applications must include curriculum vitae, bibliography and three letters of reference. The COMMITTEE ON STAFFING will solicit supplementary letters of reference. Please send applications to the COMMITTEE ON STAFFING at the above address.

UC Irvine is an Affirmative Action/Equal Opportunity Employer. The Department of Mathematics welcomes applications from women and minority candidates.

UNIVERSITY OF CALIFORNIA
LOS ANGELES
Department of Mathematics

REGULAR POSITIONS IN PURE AND APPLIED MATHEMATICS

Subject to administrative approval, two regular positions in pure and applied mathematics. The six specific search areas are as follows: 1) logic and mathematical computer science; 2) algebra (including algebraic geometry and representation theory), number theory and combinatorics; 3) geometry and topology (including dynamical systems and geometric partial differential equations); 4) analysis and differential equations (including Lie groups and mathematical physics); 5) statistics, probability and game theory; 6) applied and computational mathematics. Very strong promise in research and teaching required. Positions initially budgeted at the assistant professor level. Sufficiently outstanding candidates at higher levels will also be considered. Teaching load: averaging 1.5 courses per quarter, or 4.5 quarter courses per year. To apply, write to Alfred W. Hales, Chair, Department of Mathematics, University of California, Los Angeles, CA 90024-1555. Attn: Staff Search. UCLA is an equal opportunity/affirmative action employer.

UNIVERSITY OF CALIFORNIA
LOS ANGELES
Department of Mathematics

TEMPORARY POSITIONS

(1) Two E. R. Hedrick Assistant Professorships. Applicants must show very strong promise in research and teaching. Salary $38,500. 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, 1991.

(2) Subject to administrative approval, several Research Assistant Professorships in Computational and Applied Mathematics. Applicants must show very strong promise in research and teaching. Salary $38,500. 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, 1991.

(3) Subject to administrative approval, one or two Assistant Professorships in the Program in Computing (PIC). Applicants must show very strong promise in teaching and research, preferably in the general area of Logic and Computation. Teaching load: four quarter programming courses and an advanced quarter course of the candidate's choice per year. Two-year appointment, possibly renewable once. Salary range: $38,500-$44,000. Preference will be given to applications completed by February 1, 1991.

(4) Subject to administrative approval, one or two Lectureships in the Program in Computing (PIC). Applicants must show very strong promise in the teaching of programming. M.S. in Computer Science or equivalent degree preferred. Teaching load: five quarter programming courses per year. One-year appointment, possibly renewable up to five times, depending on the needs of the Program. Salary is based on experience and begins at $32,676. Preference will be given to applications completed by February 1, 1991.

(5) Subject to administrative approval, a few Adjunct Assistant Professorships. One year appointments, probably renewable once. Strong research and teaching background

required. Salary $33,900-$38,200. Teaching load: five quarter courses per year.

(6) Subject to administrative approval, several positions for visitors and lecturers.

To apply, write to Alfred W. Hales, Chair, Department of Mathematics, University of California, Los Angeles, CA 90024-1555. Attn: Staff Search. UCLA is an equal opportunity/affirmative action employer.

UNIVERSITY OF CALIFORNIA, RIVERSIDE
Position in Analysis

Applications and nominations are invited for a tenure-track position in Analysis beginning July 1, 1991 or later. The position is at the Assistant Professor level; candidates in all areas of classical and modern analysis (including probability theory) will be considered. Excellence in research and teaching is required. Established criteria of the University of California determine salary. To assure full consideration, applicants should send their curriculum vita and list of publications and have at least three letters of recommendation sent to:

Professor David Rush, Chair
Analysis Hiring Committee
Department of Mathematics
University of California
Riverside, CA 92521-0135

by January 21, 1991. UCR is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF CALIFORNIA, RIVERSIDE
Position in Geometric Analysis

Applications and nominations are invited for a tenured or tenure-track position in Geometric Analysis beginning July 1, 1991 or later. The position is at the rank of Assistant or Associate Professor; candidates in all areas of geometric analysis will be considered. Excellence in research and teaching is required. Established criteria of the University of California determine salary and rank. To assure full consideration, applicants should send their curriculum vita and list of publications and have at least three letters of recommendation sent to:

Professor Bun Wong, Chair
Geometric Analysis Hiring Committee
Department of Mathematics
University of California
Riverside, CA 92521-0135

by January 21, 1991. UCR is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF CALIFORNIA, RIVERSIDE
Position in Algebra or Combinatorics

Applications and nominations are invited for a tenure-track position in Algebra or Combinatorics beginning July 1, 1991 or later. The position is at the Assistant Professor level; candidates in all areas of Algebra and Combinatorics will be considered. Excellence in research and teaching is required. Established criteria of the University of California determine salary. To assure full consideration, applicants should send their curriculum vita and list of publications and have at least three letters of recommendation sent to:

Professor Richard Block, Chair
Algebra/Combinatorics Hiring Committee
Department of Mathematics
University of California
Riverside, CA 92521-0135

by January 22, 1991. UCR is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF SOUTHERN CALIFORNIA
Los Angeles, California

The Department of Mathematics wishes to fill several tenure-track Assistant Professorships and possibly tenured positions at Associate Professor and Professor. Visiting positions (at all levels) and postdoctoral appointments will also be available. The department is particularly interested in applicants who work in the areas of: Algebraic Geometry, Analysis, Geometry, Number Theory, Numerical Analysis, Partial Differential Equations, and Statistics, but strong candidates in all areas are encouraged to apply.

Applicants for assistant professorships must show strong research promise. Applicants for senior positions must have an outstanding record of research and scholastic achievement. Address inquiries to: Chair of Appointments Committee, Department of Mathematics-DRB 155, University of Southern California, Los Angeles, CA 90089-1113. USC is an Equal Opportunity/Affirmative Action Employer. Women and minorities are especially encouraged to apply.

COLORADO

UNIVERSITY OF COLORADO AT BOULDER
Department of Mathematics

Applications are invited for a faculty position in differential geometry as related to analysis, to begin in the fall of 1991. Applications at the **Assistant Professor** level are strongly preferred but other levels will be considered in extraordinary circumstances. Applications should be completed by January 21, 1990.

The University of Colorado has a strong institutional commitment to the principle of diversity in all areas. In that spirit, we are particularly interested in receiving applications from a broad spectrum of people, including women, members of ethnic minorities and disabled individuals.

Applications, including a resume and four letters of reference, should be sent to: New Appointments, Department of Mathematics, Campus Box 426, University of Colorado, Boulder, CO 80309-0426. EOE/AA

UNIVERSITY OF COLORADO AT COLORADO SPRINGS
Department of Mathematics
Colorado Springs, CO 80933-7150

Applications are invited for a tenure-track Assistant Professor position for Fall 1991. Preferred area of research interest: probability theory. However, consideration will also be given to exceptionally strong candidates if their area of expertise is consistent with present research interests: harmonic analysis, computer vision and algebra. Current faculty expertise in probability theory includes perculation theory, population genetics and theory of large deviations. Applicants should have significant research accomplishments or exceptional research promise and evidence of good teaching. Ph.D. is required. The average weekly teaching load is 7 1/2 hours. Generous support for faculty development such as travel, teaching off-loads, and summer research. Send resume and 3 letters of reference to K. M. Rangaswamy, Chairman. Screening will begin on Feb. 1, 1991 and continue until filled.

CONNECTICUT

TRINITY COLLEGE

The Department of Mathematics at Trinity College invites applications for a tenure-track position, at the rank of assistant professor, beginning in the academic year '91-'92. The normal teaching load is five semester-courses per year ("3/2"). While we will be happy to receive applications from those with any specialty, we will be particularly interested in algebraists, logicians, and persons whose research interests might intersect with current department members' areas: complex analysis, functional analysis, geometry, graph theory, combinatorics, and mathematical statistics. Requirements for the position: Ph.D. in mathematics, evidence of teaching excellence at the undergraduate level, indica-

tions of promise in research, and interest in curriculum development.

Applicants should send a c.v., three letters of reference (at least one of which addresses teaching) and a statement of teaching and research interests to

Search Committee Chair
Dept. of Mathematics
Trinity College
Hartford, CT 06106

No decision will be made prior to January 21 after which the position may be filled at any time.

Representatives of the Department will attend the employment register at the joint Annual Meetings in San Francisco in January 1991.

Trinity College is an Equal Opportunity/ Affirmative Action Employer. Women and members of minority groups are especially encouraged to apply.

DISTRICT OF COLUMBIA

THE GEORGE WASHINGTON UNIVERSITY
Department of Mathematics
Washington, D.C. 20052

Tenure-track assistant professorships available beginning August 1991, pending funding, for applicants in Geometry/Topology, Applied Mathematics, Ergodic Theory & Dynamics, or Mathematical Logic. Other outstanding candidates will also be considered. Strong research potential and a commitment to excellence in teaching required. Send resume and three letters of recommendation to: Irving J. Katz, Chairman, Department of Mathematics, The George Washington University, Washington, D.C. 20052, by February 1, 1991. The George Washington University is an Equal Opportunity/Affirmative Action Employer.

HOWARD UNIVERSITY

Mathematics: Both visiting and tenure-track positions are anticipated (rank open) for 1991-92. Ph.D., demonstrated excellence in teaching and active participation in research required. We encourage applicants in statistics, algebra and in algebraic geometry, but other applications are welcome. Send resume and direct three letters of reference to: Chairman, Mathematics Department, Howard University, Washington, D.C. 20059. Deadline: December 31, 1990. Howard University is an Equal Opportunity Employer.

FLORIDA

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
Department of Mathematics and Physical Science
Daytona Beach, Florida 32114-3900

Applications are invited for a tenure-track Assistant Professor position beginning in August 1991. A Ph.D. in Applied Mathematics is required, and a commitment to teaching excellence and scholarly activities is essential. The normal teaching load is twelve credit hours per semester. The Daytona Beach Campus has 5200 students and twenty full-time math faculty. The department offers a BS degree in Engineering Physics and provides support courses for all other academic programs. Send letter of application, resume, transcripts (unofficial), and three letters of reference to: **Chair, Department of Mathematics and Physical Science, c/o Human Resources Dept., Embry-Riddle Aeronautical University, Daytona Beach, FL 32114-3900**. Application deadline: February 15th, 1991. Women and minority group members are encouraged to apply. Equal Opportunity Employer.

FLORIDA STATE UNIVERSITY

Three positions at the rank of assistant professor are anticipated. The deadline for application is January 15, 1991, and appointments would begin August 1991. Current members of the department engage in research in algebra, analysis, applied and computational mathematics, and topology. The candidate should have potential for excellence in research and teaching. Please send resume and arrange for three letters of recommendation to be sent to Fred Kreimer, Department of Mathematics, B-154, Florida State University, Tallahassee, Florida 32306-3027. Florida State University is an Equal Opportunity/ Affirmative Action Employer.

STETSON UNIVERSITY
Department of Mathematics and Computer Science

Applications are invited for a tenure track position in mathematics at the Assistant Professor level beginning Fall, 1991. A Ph.D. in mathematics is required. Applicants should have a strong commitment to undergraduate teaching in a liberal arts environment. Teaching load: 9-10 hrs/wk. Responsibilities include teaching mathematics courses at all levels of the undergraduate curriculum, and continuing scholarly activity. The department currently has 10 full-time faculty members. Stetson University, located in Central Florida, is a small, private, comprehensive university of 2500 students. Its three schools—the College of Arts and Sciences, the School of Business, and the School of Music—are dedicated to excellence in teaching and are united by a commitment to the liberal arts. Send vitae and three letters of recommendation to: Professor Dennis Kletzing, Department of Mathematics and Computer Science, Stetson University, DeLand, Florida 32720. Deadline for applications is December 31, 1990, or until position is filled. Stetson University is an equal opportunity employer and enthusiastically solicits applications from women and minorities candidates.

UNIVERSITY OF CENTRAL FLORIDA
Department of Mathematics

Applications are invited for at least three tenured track positions at Full, Associate, Assistant Professor level beginning August 1991. Ph.D. degree in Mathematics with strong research record and dedication to teaching required for appointment at Professor or Associate Professor level. Candidates with substantial completion of Ph.D. requirements with strong teaching and research potential will be considered for the Assistant Professor level. These appointments will be made preferably in the areas of graph theory and combinatorics, numerical analysis, computational mathematics, ordinary or partial differential equations, integral equations, applied functional analysis, or applied mathematics. However, other areas of specialization may be considered provided there are no strong candidates with preferred research areas. Candidates should send a detailed resume and arrange at least three letters of recommendation and transcript sent to: Search Committee Chairman, Department of Mathematics, University of Central Florida, Orlando, Florida 32816, postmarked by December 3, 1990. Some Search Committee members may be available at the San Francisco meeting in January 1991 for an interview. The University is an equal opportunity affirmative action employer. As an agency of the State of Florida, UCF makes all application materials and selection procedures available for public review.

THE UNIVERSITY OF FLORIDA
Department of Mathematics

In each of the next several years, the Department of Mathematics intends to fill a number of tenure-track faculty positions with mathematicians of exceptional caliber. In the coming year, special consideration will be given to filling positions in the following areas of research: algebraic geometry and number theory, topology, numerical analysis, and probability theory. However, outstanding can-

didates from all areas of pure and applied mathematics are invited to apply for these positions.

Candidates at all ranks will receive serious consideration, but it is expected that most positions will be filled at the level of assistant professor. Applications from junior candidates with post-doctoral experience are especially welcome.

Senior candidates should have distinguished research records, and junior candidates are expected to have made significant research contributions. Every candidate is expected to possess a strong commitment to teaching. Candidates should forward a resume (including a list of publications) and should arrange for at least four letters of recommendation to be sent to:

David A. Drake, Chair
Department of Mathematics
University of Florida
201 Walker Hall
Gainesville, FL 32611-2082

All applications for the academic year 1991-92 should be complete by December 31, 1990. The University of Florida is an equal opportunity employer and energetically solicites applications from women and minority candidates.

NEW COLLEGE OF USF

Tenure-track position in Mathematics starting Fall, 1991, pending budgetary approval. Duties consist of two classes per semester, plus individual or group tutorials and supervising senior theses (these are required for all students). New College is a small, highly selective liberal arts college with a student/faculty ratio of 10:1. We have a system of contracts and written evaluations rather than grades. A report released by the Independent Colleges Office ranks us sixth in productivity of Ph.D.s for students who graduated between 1970 and 1982. Continuing faculty in Mathematics are an Analyst, an Algebraist/Computer Scientist, and an Algebraic Geometer. Women and minority candidates are especially encouraged to apply. Submit application by January 31 with vita, three letters of recommendation, and a statement on your teaching philosophy to Tony Horowitz, Division of Natural Sciences, New College, 5700 N. Tamiami Trail, Sarasota, FL 34243-2197. New College of the University of South Florida is an AAEO employer.

GEORGIA

GEORGIA INSTITUTE OF TECHNOLOGY

The School of Mathematics expects to have some visiting and tenure-track positions in several areas, including probability and statistics, at various levels beginning in Fall 1991. Candidates with strong research and teaching records or potential should send a resume, at least three letters of reference, and a summary of future research plans to The Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, Georgia 30332-0160. Georgia Tech, a member of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF GEORGIA
Department of Mathematics
Athens, GA 30602

The department has tenure-track positions available for the 1991-92 academic year at the assistant professor level. In addition there may be some visiting positions available. The salary will be commensurate with the applicant's abilities and experience. The principle requirement is excellence in teaching and research. Some preference will be given to areas in which the department is already well represented. Send curriculum vitae and four letters of recommendation to Richard E. Bouldin Head (address above) by January 15, 1991. UGA is an Equal Opportunity/Affirmative Action Employer.

HAWAII

UNIVERSITY OF HAWAII
Department of Mathematics

Applications are invited for some anticipated positions beginning Fall 1991 or Spring 1992, one tenure-track and some temporary. Rank open. Duties include mathematical research and teaching 6 credit hours per semester. Minimum qualifications include a Ph.D., commitment to research and teaching, and achievement appropriate to rank. Research interests complementing those of the Department are desirable. Normal salary range as of 7/91 is from $32,364 (minimum for assistant professor) to $73,752 (maximum for full professor). To apply, write to Professor L. Thomas Ramsey, Chairman, Department of Mathematics, 2565 The Mall, Keller 401A, Honolulu, HI 96822. Have 3 references send confidential letters directly to the chairman. DEADLINE FOR APPLICATIONS: 01/31/91. The University of Hawaii is an Equal Opportunity/Affirmative Action Employer.

ILLINOIS

BRADLEY UNIVERSITY
Department of Mathematics

Applications are invited for an entry-level tenure-track position at the rank of Assistant Professor beginning August 1991. Candidates should have a strong commitment to undergraduate teaching. The Ph.D. is required, and continuing professional growth (publication) is required for tenure and advancement. Ordered preference will be given to applicants in the fields of applied statistics, geometric topology, and commutative algebra. Salary is competitive. The closing date is January 21, 1991, or until the position is filled. Other positions may become available at a later date. Send Letter of application, vita, and three or more letters of recommendation to: Dr. T. V. Sastry, Search Committee, Department of Mathematics, Bradley University, Peoria, IL 61625. Bradley University is an AA/EO employer. Women and minorities are encouraged to apply.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Department of Mathematics

Applications are invited for one or more tenure-track or tenured faculty positions commencing in August 1991. While we are particularly interested in the areas of applied mathematics, combinatorics, and optimization, outstanding candidates in all fields of mathematics are strongly encouraged to apply and will be seriously considered. Some visiting appointments for the 1991-92 academic year are also anticipated. Salary and teaching load are competitive. Candidates 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

C. Ward Henson, Chair
Department of Mathematics
University of Illinois at
Urbana-Champaign
1409 W. Green St.
Urbana, Illinois 61801
tel. (217)333-3352

In order to ensure full consideration, all application materials including letters of reference should be received by December 1, 1990. Interviews may be conducted prior to December 1, 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

BALL STATE UNIVERSITY
Muncie, Indiana
Mathematics

Tenure-track positions anticipated August 1991. Ph.D. in pure or applied mathematics required. Specialty is open, though preference will be given to candidates whose research interests are compatible with those of the present faculty. Present faculty research interests include differential equations, numerical analysis, computation, combinatorics or combinatorial geometry, low-dimensional or general topology. Appointment at assistant professor level. Successful college or university level teaching level required. Publications and/or evidence of other scholarly productivity desired. Teaching responsibilities may include introductory classes as well as courses related to specialty area. Salary negotiable. Send resume and three letters of recommendation to Dr. Hubert J. Ludwig, Faculty Search Committee, Department of Mathematical Sciences, Ball State University, Muncie, IN 47306. Review of applications will begin December 10, 1990 and continue until position is filled.

Ball State University Practices Equal Opportunity in Education and Employment.

BUTLER UNIVERSITY
Department of Mathematical Sciences

A tenure-track position teaching courses in our undergraduate computer science and mathematics majors is available beginning Fall 1991. Must have a Ph.D. in computer science or a Ph.D. mathematical science with at least master's level competency in computer science. Rank and salary are open and will depend on qualifications. Academic computing facilities include a VAX 6410 and numerous Macintosh and IBM compatible micro-computers. Butler University is a comprehensive, medium-sized, liberal arts-based institution, with a beautiful campus located in a residential area of Indianapolis. Send vitae and three letters of recommendation, at least one addressing teaching effectiveness, by February 1, 1991, to: Professor Prem L. Sharma, Department of Mathematical Sciences, Butler University, 4600 Sunset Ave., Indianapolis, IN 46208 EOE/AA.

INDIANA STATE UNIVERSITY
Chairperson
Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science, Indiana State University, invites applications for the position of Chairperson. Applicants should have a doctorate in Mathematics or Computer Science, a record of successful teaching and research, and a commitment to promoting research, teaching, and other scholarly activities. Applicants should also possess the leadership skills necessary to chair a large department which has diverse teaching and research responsibilities. The Computer Science area is undergoing active development, so familiarity with Computer Science curricular issues is desirable.

The Department offers BS and BA degrees in Mathematics, Mathematics Education and Computer Science, as well as MS and MA degrees in Mathematics and Mathematics Education. It is developing an MS degree in Computer Science.

Salary and rank are commensurate with qualifications and experience., Please send a letter of application and vita, and have three letters of recommendation sent to:

Chairperson Search Committee
Department of Mathematics and
Computer Science
Indiana State University
Terre Haute, IN 47809

The application deadline is January 14, 1991. Applications received after this date cannot be guaranteed consideration. U.S. citizenship or eligibility for U.S. employment will be required. Indiana State University is an Equal Opportunity/Affirmative Action Employer.

INDIANA UNIVERSITY-PURDUE UNIVERSITY AT INDIANAPOLIS (IUPUI)
Department of Mathematical Sciences

The Department of Mathematical Sciences at IUPUI is seeking applicants for a senior position, at the level of full professor, in scientific computing/numerical analysis. The preferred starting date is January 1, 1991. A later starting date is negotiable. The successful candidate is expected to provide leadership to a new interdisciplinary program in computational science to be developed jointly by the Department of Mathematical Sciences and the Department of Comptuer & Information Science.

Applicants must have an earned doctorate, a strong background in applied and numerical analysis, a commitment to excellence in teaching, and a demonstrated record of research accomplishments. Special preference will be given to candidates whose expertise and interest are in the development of asymptotics based numerical methods and their applications to large-scale scientific problems.

IUPUI is a rapidly growing comprehensive urban university with over 26,000 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. Applications and inquiries should be addressed to Prof. Bart S. Ng, Chair, Department of Mathematical Sciences, IUPUI, 1125 E. 38th Street, Indianapolis, IN 46205-2810. Closing date: December 1, 1990. Late applications will be considered until position is filled.

IUPUI is an Affirmative Action/Equal Opportunity Employer

Woman and minority candidates are encourage to apply

IOWA

IOWA STATE UNIVERSITY

The Department of Mathematics of Iowa State University invites applications to fill three tenure-track positions for the 1991-92 academic year. Start up funds will be available for the successful applicant for each position. The areas of interest and the level are (1) a senior position in numerical analysis or computational mathematics, (2) an entry level position in control theory and (3) an entry level in mathematics education. The successful candidate for each position is expected to have a strong interest in teaching at both the graduate and undergraduate level and maintain an active research program in his or her chosen area. In addition, candidates for the senior position are expected to have a strong research record, be willing to build a strong research group in numerical analysis or computational mathematics, to interact with colleagues in related areas and to seek outside funds for their research.

We will begin screening applications December 15, 1990. However we shall continue to accept applications until the positions are filled.

Iowa State University is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encouraged to apply.

Applications and three letters of recommendation should be sent to Howard A. Levine, Chair, Department of Mathematics, Iowa State University, Ames, Iowa 50011.

UNIVERSITY OF IOWA

The Mathematics Department of the University of Iowa invites applications for the following positions:

1. Three tenure-track appointments at the Assistant or beginning Associate Professor level beginning in the 1991-92 academic year. One of these is to be in numerical analysis and two are to be filled by specialists in harmonic analysis or probability theory. Selection will be based on evidence of outstanding research accomplishments or potential, and

teaching ability. A Ph.D. or equivalent training is required.

2. One senior faculty position beginning in 1991-92 academic year or later. Only applicants of extraordinary stature will be considered. A strong record of leadership in teaching and research in one of the department's current or developing areas of strength is required.

3. Pending availability of funds, one or more visiting positions for all or part of the 1991-92 academic year. Selection will be based on research expertise and teaching ability. Preference will be given to applicants whose scholarly activity is of particular interest to members of the current faculty.

Women and minority candidates are especially urged to apply for any of the above positions. The University of Iowa welcomes the employment of highly qualified professional couples on its faculty and staff, permits the appointment of faculty couples within the same department, and permits the sharing of a single appointment by a faculty couple.

Applications will be received until January 31, 1991, or until the positions are filled. To apply send a complete vita and have three letters of recommendation sent to:

Professor W. A. Kirk, Chair
Department of Mathematics
University of Iowa
Iowa City, Iowa 52242

The University of Iowa is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF NORTHERN IOWA
Department Head

Mathematics and Computer Science at the University of Northern Iowa, a department with a strong tradition of excellence in teaching and teacher preparation and a growing program of scholarship and research in mathematics, computer science, and mathematics education, is seeking a new department head. Responsibilities include budgeting; faculty assignment, evaluation, & development; external relations; and some teaching and scholarly activity. Required characteristics include being appointable as a full professor in the department, leadership & academic administrative skills, and good communication skills.

Appointment will cover the academic year plus summer session and begin June or August, 1991. Yearly salary will be near $70,000 plus excellent fringe benefits. Application screening begins January 14, 1991. For further information, contact Philip East, Mathematics and Computer Science, University of Northern Iowa, Cedar Falls, IA 50614-0506. UNI is an Affirmative Action/Equal Opportunity Educator and Employer.

KENTUCKY

MURRAY STATE UNIVERSITY
Department of Mathematics and Statistics

Applications are invited for tenure-track positions at the Assistant/Associate Professor level beginning August 1991. Preference will be given to applicants in statistics and mathematics education.

Responsibilities will include a maximum three course teaching load consisting of a wide variety of undergraduate and graduate level courses, continuing research/scholarly activities, and university/departmental service. A Ph.D. in statistics or a Ph.D. in applied mathematics with a statistics background is required for the statistics position. The mathematics education position requires a Ph.D. in mathematics education or a Ph.D. in mathematics with a background in mathematics education. Salary will be competitive. Screening will begin January 14, 1991 and continue until the positions are filled.

Applicants who are not U.S. citizens must provide their visa status and any other information relevant to their ability to accept employment.

Send letter of application with vita, graduate transcripts or a list of graduate courses taken, and direct three letters of recommendation to:

Dr. Robert Pervine, Search Committee Chair
Department of Mathematics and Statistics
Murray State University
Murray, KY 42071

MSU is an EO/AA employer.

UNIVERSITY OF LOUISVILLE
Department of Mathematics

The Department of Mathematics is seeking applications for at least three (3) entry level tenure-track positions. Candidates will be expected to have an active research program in applicable mathematical sciences. Primary teaching responsibilities will involve courses at all levels including general education courses. A Doctorate in the Mathematical Sciences is required. Teaching experience is desirable. Interested candidates should send a letter of application, curriculum vitae and at least three letters of recommendation by February 1, 1991 to:

Dr. Robert B. McFadden
Chair, Department of Mathematics
University of Louisville
Louisville, KY 40292

The University of Louisville is an Affirmative Action/Equal Opportunity Employer.

MAINE

BOWDOIN COLLEGE
Brunswick, Maine 04011

Mathematics Department: Two tenure-track Assistant Professorships starting Fall, 1991. Initial appointment for three years with renewal possible. Ph.D. required and strong research record or potential expected. Field open, but a preference will be given to candidates in applied mathematics for one position. Normal teaching load is two courses per semester. Candidates with record of effective undergraduate teaching preferred. Review of candidates begins 15 January, but applications will be considered until both positions are filled. Women and minorities are encouraged to apply. Send resume and 3 letters of recommendation to Wells Johnson, Chair, Department of Mathematics, Bowdoin College, Brunswick, ME 04011. Bowdoin College is committed to Equal Opportunity through Affirmative Action.

MARYLAND

THE JOHNS HOPKINS UNIVERSITY

Applications are invited for positions at all levels in fields of interest to the department. Two of the positions represent part of the Department's commitment to increase its representation in analysis. Areas of particular interest are partial differential equations, and geometric analysis. Outstanding research accomplishments and commitment to teaching are required. Minority and women candidates are encouraged to apply. The Johns Hopkins University is an affirmative action/equal opportunity employer. Applications should be sent to Search Committee, Department of Mathematics, The Johns Hopkins University, Baltimore, Maryland 21218. Applicants in statistics & probability, operations research & optimization, discrete mathematics, matrix analysis and numerical analysis should contact the Dept. of Mathematical Sciences which is distinct from the Department of Mathematics.

THE JOHNS HOPKINS UNIVERSITY

Applications are invited for a junior position in statistics, to begin in Fall 1991. Selection is based on demonstration and promise of excellence in research, teaching, and innovative application. AA/EOE. Applicants are asked to furnish a vita, transcripts, a letter describing professional interests and aspirations, and arrange for three letters of recommendation to be sent to Prof. John C. Wierman, Chairman, Mathematical Sciences

Department, The Johns Hopkins University, Baltimore, MD 21218

JOHNS HOPKINS UNIVERSITY

The Mathematical Sciences Department invites applications for the 1991-92 ELIEZER NADDOR POSTDOCTORAL FELLOWSHIP.

The Fellow is to be an outstanding graduating doctoral student in mathematics, statistics, or operations research, who plans an academic research career. The fellowship provides full support for 12 months of postdoctoral study at the department in an area of interest to some department faculty member, free from teaching and administrative duties. Selection is made without discrimination on the basis of race, color, religion, sex, or national origin. Applicants should provide a current vita, a letter describing career aspirations and a research plan for the fellowship year, and transcripts, and should arrange for three letters of recommendation to be sent, by January 15, 1991, to:

Professor John C. Wierman, Chairman
Mathematical Sciences Department
220 Maryland Hall
The Johns Hopkins University
Baltimore, Maryland 21218

Applicants for positions in algebra, analysis, differential equations, geometry, number theory, and topology should contact the Mathematics Department instead of the Mathematical Sciences Department. AA/EOE

UNIVERSITY OF MARYLAND
UNIVERSITY COLLEGE
Teach in Asia or Europe

The University of Maryland University College seeks excellent teachers for openings on U.S. military bases overseas. Appointments begin August 1991. Requirements include M.A. or Ph.D., recent college teaching experience, and U.S. citizenship. Competence to teach in another discipline desirable. Benefits include transportation and military base privileges (PX, commissary, etc.). Frequent travel and the cost of schooling make these positions difficult for those with children. Send resume to Dr. Ralph E. Millis, Assistant to the President, Overseas Programs, The University of Maryland University College, College Park, MD 20742-1642. AA/EEO.

WASHINGTON COLLEGE
Department of Math and Computer Science
Chestertown, Maryland 21620

Washington College announces a tenure-track position at the assistant professor level starting fall 1991. This is a teaching position involving instruction throughout the normal undergraduate mathematics curriculum and some computer science. A Ph.D. in one of the Mathematical Sciences or Computer Science is required. Applicants should send a letter of application *including a brief essay on the role of mathematics in a liberal arts education*, a resumé, transcripts, at least three letters of recommendation, to Dr. Albert W. Briggs, Jr. at the address above. Evaluation of candidates will begin in mid-December and continue until the position is filled. Interviews will be conducted at the annual meeting in San Francisco. Washington College is an equal opportunity employer.

MASSACHUSETTS

BOSTON UNIVERSITY
Department of Mathematics

The Department of Mathematics at Boston University invites applications for two anticipated positions in the area of Dynamical Systems. One position is a permanent position at the Assistant Professor level. The successful applicant should have a strong commitment to research and teaching. The Department also seeks applications for a Visiting Assistant Professorship in this field. Applications and 3 letters of reference should be sent to: Search Committee, Department of Mathematics, Boston University, 111 Cummington St., Boston, MA 02215. AA/EOE.

MICHIGAN

CENTRAL MICHIGAN UNIVERSITY

Three tenure-track positions and one tentative tenure-track position. All are at assistant professor rank. Priorities for the three indicated positions are 1. Functional analysis/operator theory, 2. Combinatorics/design theory and 3. Mathematics education. The tentative position is in statistics and its status will be determined by January 1991. Statistics candidates may also be considered as a fourth priority for one of the three positions mentioned above. Candidates for all positions should have a doctorate in the appropriate field of mathematics, show promise of excellence in teaching, and have demonstrated research ability. Candidates in mathematics education should have teaching experience in K-12 and the ability to teach undergraduate mathematics courses. Duties include teaching and research with a normal teaching load of 9 semester hours. Preference will be given to candidates who complement existing research interests in the Department. Salaries are competitive and benefits include university-paid TIAA, medical, dental, group life. Send resume, transcripts and three letters of recommendation to R. J. Fleming, Dept. of Mathematics, Central Michigan Univ., Mt. Pleasant, MI 48859 by January 21, 1991. Late applications will be received until the positions are filled. Central Michigan University is an Affirmative Action/Equal Opportunity Employer. All persons including members of minority groups, women, handicapped persons, disabled veterans and veterans of the Vietnam Era are encouraged to apply.

FERRIS STATE UNIVERSITY
Head, Department of Mathematics

Ferris State University invites nominations and applications for the position of Head of the Department of Mathematics. The Department of Mathematics currently has 22 faculty and is responsible for undergraduate education in math and computer science and for baccalaureate programs in Applied Mathematics and Actuarial Science. QUALIFICATIONS: An earned doctorate in Mathematics or Applied Mathematics, or an earned doctorate in Mathematics Education with a Master's in Mathematics; professional development and teaching experience appropriate to senior rank; familiarity with a broad spectrum of math instruction; ability to work with others in a broad array of disciplines; and personal qualities of integrity, industriousness, organization, leadership and interpersonal skills.

Ferris State University is a career-oriented, open-admissions, state-funded institution in western Michigan with 12,000 students and over 120 degree programs. Its Schools include Allied Health, Arts and Sciences, Business, Education, Pharmacy, Technology, and the College of Optometry.

Review of applications is in progress and will continue until the position is filled. Send letter of interest, curriculum vita, 3 letters of reference, and official transcripts to: George Wales, Search Committee Chair, Starr 120, Ferris State University, Big Rapids, MI 49307.

GRAND VALLEY STATE UNIVERSITY
Allendale, Michigan

Tenure-track positions are open for Fall 1991, in Mathematics, Math Education, Statistics, Computer Science, and Information Systems. Duties include teaching undergraduate and/or graduate courses, student advising and professional development. Earned doctorate and strong teaching recommendations required.

The Grand Valley campuses are located in greater Grand Rapids, the second largest metropolitan area in Michigan, offering numerous cultural and recreational opportunities. Cost of living is moderate and quality of life is high. Send resume and names of three references to: Search Committee, Mathematics and Computer Science Dept., GVSU, Allendale, MI 49401. Applications will

be accepted until positions are filled. GVSU is an EO/AAI.

OAKLAND UNIVERSITY
Chairperson, Department of Mathematical Sciences

Applications and nominations are invited for the position of Chairperson. Minimum qualifications include an earned Ph.D. in a mathematical science, significant post-Ph.D. academic experience in the mathematical sciences or comparable activity, a substantial research record and an active commitment to research, demonstrated experience in various academic or professional leadership positions, and an academic record to justify appointment at the rank of Professor in the Department of Mathematical Sciences with tenure. The department has 30 regular faculty members and about 30 part-time faculty and graduate assistants and is in the planning process for establishing a Ph.D. program. An applicant should send a letter, vita, and the names, addresses, and telephone numbers for at least three references. Send nominations and applications to Chairperson Search Committee, Department of Mathematical Sciences, Oakland University, Rochester, MI 48309-4401. Review of applications will begin December 12, 1990, OU is an AA/EO employer.

MISSOURI

UNIVERSITY OF MISSOURI
Department of Mathematics
Columbia, MO 65211

Applications are invited for two tenure-track positions at the rank of assistant professor beginning in August of 1991. The positions require a Ph.D., quality teaching, and a commitment to a distinguished research career. Selections for each position will be based primarily on demonstrated research achievement in an area complementary to areas of ongoing departmental research. Send a curriculum vitae along with a letter of application, and arrange for three letters of recommendation to be sent to Professor L. J. Lange, Chair, at the address above. The application deadline is January 22, 1991, or until the positions are filled thereafter. Applications received after March 1, 1991, cannot be guaranteed consideration. AA/EOE.

UNIVERSITY OF MISSOURI-ROLLA
Department of Mathematics and Statistics, Rolla, MO 65401

One or more tenure-track positions are anticipated for the fall of 1991. Rank and salary are open and depend on qualifications, but applicants must have the Ph.D. completed by August 15, 1991. Preference will be given to those whose research area complements departmental research or fills a need. Algebra is an area of need at the professor or associate professor level where research accomplishment, teaching ability and experience in developing Ph.D. students will be major factors in the selection. For any entry level position, training, research potential and teaching ability of the candidate will be considered in the selection. Submit curriculum vitae, summary of research, transcripts and three letters of reference to W. T. Ingram, Chairman. Applicant review will begin in December 1990. In order to receive full consideration, please have all materials in by December 15. AA/EOE.

UNIVERSITY OF MISSOURI - ST. LOUIS

The Department of Mathematics and Computer Science seeks applicants for two tenure-track positions at the rank of assistant or associate professor, one each in mathematics and computer science. Duties include teaching and research. Candidates should have a strong commitment to good teaching. Special consideration will be given to individuals whose research interests overlap those of present members of the department. Candidates for an associate professorship must have a substantial publication record.

Candidates for the position of assistant or associate professor of mathematics should hold the Ph.D. degree in mathematics (or equivalent terminal degree). Areas of particular interest are group representation theory, algebraic geometry, and special functions.

Candidates for the position of assistant or associate professor of computer science should hold the Ph.D. degree in computer science (or equivalent terminal degree).

The University of Missouri - St. Louis is located in suburban St. Louis, Missouri, and is one campus of the four-campus University of Missouri System.

Please send resume, and have three letters of recommendation sent to Dr. Edward Andalafte, Department of Mathematics and Computer Science, University of Missouri - St. Louis, St. Louis, MO 63121-4499, by January 15, 1991. Review of applications will begin on December 1, 1990. Applications will be considered until the position is filled. The University of Missouri is an Affirmative Action/Equal Opportunity Employer.

NEBRASKA

UNIVERSITY OF NEBRASKA-LINCOLN

Applications are invited for a tenure-track position at the Assistant Professor level beginning in the fall of 1991. Candidates must have a Ph.D. in mathematics or expect to receive their degree by August of 1991. Candidates must have excellent teaching ability and outstanding research potential in an area which will complement the existing expertise in the department. Applications accepted from qualified candidates in all areas of mathematics, but candidates in numerical analysis, differential geometry, operations research, operator theory and combinatorics are particularly urged to apply. Women and minority candidates are also encouraged to apply. Send vita and three letters of recommendation to Search Committee Chair, Department of Mathematics and Statistics, University of Nebraska-Lincoln, Lincoln, NE 68588-0323. The review of applications will begin February 1, 1991, and continue until a candidate is selected.

NEVADA

UNIVERSITY OF NEVADA, RENO
Department of Mathematics

The University of Nevada, Reno invites applications for the combined position of Chair of the Department of Mathematics and Professor in the Department. Employment starts 1 July 1991. Duties of the Chair are initially for three full years. The salary will be commensurate with qualifications of the applicant and be competitive. The University contributes to TIAA-CREF retirement.

The Department has 15 members and offers B.A. and M.S. degrees in mathematics. It provides substantial service to other departments. The University has a separate Computer Science Department and several other departments offer Ph.D.s. The Mathematics Department and its programs are growing.

Applicants should have substantial and continuing records of research and scholarly achievement and be dedicated to excellence in teaching. They should have the capacity to lead the Department in a period of growth.

Biographical information and five letters of reference should be sent to R. N. Thompson, Department of Mathematics, University of Nevada, Reno, Reno, NV 89557, [(702)784-6775; email address: rt@tahoe.unr.edu; FAX: 702-784-1300] and be received by 4 February 1991. Department representatives will be

available for preliminary interviews at the AMS meetings in San Francisco in January.

The University of Nevada, Reno is an Equal Opportunity/Affirmative Action Employer and does not discriminate on the basis of race, creed, color, sex, age, national origin, veteran status or handicap in any program or activity it operates. University of Nevada employs only United States citizens and aliens lawfully authorized to work in the United States.

NEW HAMPSHIRE

DARTMOUTH COLLEGE
John Wesley Young Research Instructorship

The John Wesley Young Research Instructorship is a two year post-doctoral appointment for promising new or recent Ph.D.'s whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, algebraic geometry, combinatorics, computer science, differential geometry, logic and set theory, number theory, probability and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's specialty and include elementary, advanced and (at instructor's option) graduate courses. Nine-month salary of $32,500 supplemented by summer (resident) research stipend of $7,150 (two-ninths). Send letter of application, résumé, graduate transcript, thesis abstract, description of other research activities and interests if appropriate, and 3 or preferably 4 letters of recommendation (at least one should discuss teaching) to Phyllis A. Bellmore, Department of Math and CS, Bradley Hall, Hanover, NH 03755. Applications received by Jan. 15 receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to affirmative action and strongly encourages applications from minorities and women.

NEW JERSEY

RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY

Rutgers, The State University of New Jersey. Department of Mathematics, New Brunswick, NJ anticipates the following open positions beginning September 1991.

(1) **Tenure-track and tenure positions**. The Department anticipates several openings. Depending on the qualifications of the applicants, appointments may be as tenure-track assistant professorships or as tenured associate, full, or special professorships. Candidates must have Ph.D., outstanding research ability in pure or applied mathematics and concern for teaching. Normal course load now averages 5 hours. Preference given to applicants working in Lie theory, topology, geometric analysis, and ring theory (ideally interacting with algebraic geometry). However, exceptionally strong candidates in all fields are encouraged to apply and will be given careful consideration.

(2) **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 but one course teaching reduction provided in two of the three years.

(3) **Lectureships**. (Assistant Professor level and above). Normal course load approx. 6 hours. Candidates must have Ph.D., show outstanding promise in research ability in pure or applied mathematics and have concern for teaching. These are one or two year non-tenure-track positions.

(4) **Instructorships**. Responsible for teaching mainly at the level of precalculus and below. Normal course load 12 hours. Candidates must have masters degree or equivalent related experience and provide evidence of teaching ability. These are one or two year non-tenure-track positions.

(5) **Visiting Positions**; part-time and full-time. Normal full-time course load approx. 6 hours. These positions are intended to permit individuals with regular appointments elsewhere to visit Rutgers for the purpose of engaging in joint research with members of the faculty. Candidates must have Ph.D., proven record of outstanding research accomplishments in pure or applied mathematics, and concern for teaching. These are one or two year non-renewable positions.

(6) **Part-time Positions** (all levels). These may be used both for candidates with primary responsibility for teaching and for candidates with outstanding promise in research activity.

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.

NEW MEXICO

THE UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico
Department of Mathematics and Statistics

The Department expects to have up to three tenure-track positions available, beginning in the Fall Semester, 1991. We are particularly interested in candidates at the assistant professor level, but will consider outstanding applicants at all levels. Candidates must have relevant postdoctoral or equivalent professional experience beyond the Ph.D. and a strong research record. A commitment to excellence in teaching is also expected.

The Department of Mathematics and Statistics currently has 41 faculty members and an active and expanding graduate program. The Department has close research ties with Los Alamos and Sandia National Laboratories, and access to major computing facilities. Joint appointments with other departments are possible.

Review of applications will begin December 15, 1990, and will continue until the positions are filled. All exceptionally strong candidates, especially women and minority group members, are urged to apply. Please have vita and three letters of reference sent to:

Professor Alex Stone, Chair
Hiring Committee
Department of Mathematics and Statistics
The University of New Mexico
Albuquerque, NM 87131

The University of New Mexico is an AA/EEO.

NEW YORK

JOHN JAY COLLEGE OF CRIMINAL JUSTICE THE CITY UNIVERSITY OF NEW YORK
Department of Mathematics

Assistant Professor, tenure-track position, January, 1991. Requirements: Ph.D.; demonstrated potential for research; strong commitment to teaching. Computer science, numerical analysis or operations research background preferred. John Jay College of Criminal Justice, located in Manhattan, is a senior college in CUNY. Send resume, graduate transcript, relevant reprints, dissertation abstract and three letters of reference to Sydney Samuel, Chairperson, Department of Mathematics, John Jay College of Criminal Justice, 445 West 59 Street, New York, NY 10019 by December 1, 1990. Minorities and women are encouraged to apply. AA/EOE Employer.

HOBART AND WILLIAM SMITH COLLEGES
Department of Mathematics and Computer Science

Two Assistant Professor, tenure-track positions starting in September 1991. Salary is competitive.

For the first position applicants should have a Ph.D. in computer science or a Ph.D. in mathematics and experience in computer science. Duties include teaching undergraduate computer science, participating in the

Colleges' Interdisciplinary General Curriculum, and the possibility of teaching some mathematics (depending on interests and qualifications).

For the second position applicants should have a Ph.D. in mathematics; specialty open, but preference may be given to algebraists, applied mathematicians, or those with demonstrated computer science expertise. Duties include teaching undergraduate mathematics, participating in the Colleges' Interdisciplinary General Curriculum, and the possibility of teaching some computer science (depending on interests and qualifications).

For both positions a strong commitment to teaching and promise of continued scholarly activity is required. Teaching load: two courses per trimester. Hobart College for men and William Smith College for women are coordinate, four year, liberal arts colleges committed to teaching and interdisciplinary study with a combined enrollment of 1900 students. Within an hour's drive are three major universities: Cornell, Rochester, and Syracuse.

Send detailed resume, three letters of recommendation (at least one including comments on teaching), and undergraduate and graduate transcripts (photocopies acceptable) to: Prof. Kevin Mitchell, Faculty Box 75, Department of Mathematics and Computer Science, Hobart and William Smith Colleges, Geneva, NY 14456. Evaluation of applications will begin December 15, 1990 and will continue until the position is filled. Women and minorities are strongly encouraged to apply. An Equal Opportunity/Affirmative Action Employer.

ITHACA COLLEGE

The Department of Mathematics and Computer Science at Ithaca College has two tenure eligible positions in mathematics available for the 1991-92 academic year. Qualifications: Ph.D. preferred, active ABD's considered. Rank: Assistant Professor or above. All successful candidates will be expected to teach a wide variety of mathematics courses at the undergraduate level. Screening begins December 17, 1990. Send vitae to Dr. Eric Robinson, Chair, Department of Mathematics and Computer Science, Ithaca College, Ithaca, NY 14850. An Affirmative Action/Equal Opportunity Employer.

POLYTECHNIC UNIVERSITY
Department of Mathematics

As a result of retirements, the Department of Mathematics anticipates a number of tenured and tenure-track openings in Statistics in the next few years. A senior appointment at the Associate or Full Professor level is available beginning in the 1991-92 academic year. An appointment at the Assistant Professor level will also be considered for candidates with outstanding promise. Applicants for the senior position should have an established and recognized research program, proven ability to attract external research support, and interest in building and leading a strong research group. Candidates should also possess a proven record of excellence in teaching at both the undergraduate and graduate levels and should be committed to professional interaction with faculty and Ph.D. students. While applications from all areas of Statistics are welcome, the department has special interests in experimental design, quality control, and inference for stochastic processes.

There will also be opportunities for research cooperation with faculty and students in Electrical Engineering on problems of statistical pattern recognition, robust detection and estimation theory for radar and communications, and adaptive statistical procedures.

The review of applications will begin on January 1, 1991. Candidates interested in the position should send a letter of application, a curriculum vitae, the names of four people who have agreed to write letters of recommendation, and a description of research interests to:

Professor Burton Lieberman, Department of Mathematics, Polytechnic University, 333 Jay Street, Brooklyn, New York 11201. An Equal OpportunityEmployer/M/F/H/V

SPRINGER-VERLAG NEW YORK, INC.
Mathematics Editorial

Due to the ongoing development of our mathematics program, Springer-Verlag New York has available editorial opportunity for individual with advanced degree(s) in mathematics. Responsibilities will include the acquisition and evaluation of new manuscripts and the supervision of pre-production manuscript development. Candidates will be considered at either the full editor level or associate editor level depending on experience. The position is New York City-based and requires travel.

We offer a competitive salary and an excellent benefits package including dental and 401(k). Interested individuals please send resume and cover letter to:

Laura Jones
Sr. Personnel Associate
Sprinver-Verlag New York, Inc.
175 Fifth Avenue
New York, NY 10010

Selected candidates will be interviewed at the American Mathematical Society Annual Meeting in San Francisco, CA (January 1991).

STATE UNIVERSITY OF NEW YORK AT BUFFALO
Mathematics

The Department of Mathematics anticipates the appointment of several tenured or tenure-track faculty members beginning September 1, 1991. Salary will be competitive. Outstanding applicants in all fields of mathematics are encouraged to apply. We seek applicants with excellent research accomplishments/potential and a strong commitment to teaching.

Applicants should send any supporting information and have four letters of recommendation sent to:

Dr. Nicolas Goodman
Search Committee Chairman
Department of Mathematics
SUNY/Buffalo
106 Diefendorf Hall
Buffalo, New York 14214

The deadline for applications is December 1, 1990. Late applications will be considered until positions are filled.

SUNY/Buffalo is an Equal Opportunity/Affirmative Action Employer. We are interested in identifying prospective minority and women candidates. No person, in whatever relationship with the State University of New York at Buffalo shall be subject to discrimination on the basis of age, creed, color, handicap, national origin, race, religion, sex, marital or veteran status.

NORTH CAROLINA

DUKE UNIVERSITY
Department of Mathematics

Applications are invited for one or more tenure-track positions in Mathematics, rank and salary open, all fields, starting September 1, 1991. Applicants should send a curriculum vitae, a research plan, and should arrange for three letters of recommendation to be sent. Complete applications received by January 1, 1991 will be guaranteed full consideration. Address correspondence to: Faculty Search Committee, Department of Mathematics, Duke University, Durham, NC 27706. Duke University is an Affirmative Action/Equal Opportunity Employer.

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Department of Mathematics
Chapel Hill, NC 27599

Applications are invited for tenure-track appointments effective Fall 1991. Rank and salary depend on qualifications and budget considerations. Ph.D., exceptionally strong research program and commitment to excel-

lent teaching required. Send curriculum vitae, abstract of current research program and four letters of recommendation to Search Committee Chairman, Mathematics Department, CB# 3250 Phillips Hall, UNC at Chapel Hill, Chapel Hill, NC 27599-3250. EO/AA Employer. Women and minorities are encouraged to identify themselves voluntarily. Completed applications received by January 15, 1991 are assured of full consideration.

WAKE FOREST UNIVERSITY
Department of Mathematics and Computer Science

Applications are invited for two tenure track positions in mathematics at the assistant professor level beginning August 1991. Duties include teaching mathematics at the undergraduate and graduate levels and continuing research. A Ph.D. is required. The department has 22 members and offers a B.S. and M.A. in mathematics and a B.S. in computer science. Send letter of application and resume to Richard D. Carmichael, Chairman, Department of Mathematics and Computer Science, Wake Forest University, Box 7311, Winston-Salem, NC 27109. AA/EO employer.

OHIO

AIR FORCE INSTITUTE OF TECHNOLOGY

The Air Force Flight Dynamics Laboratory and the Air Force Institute of Technology announce the 1991-1993 Flight Control Distinguished Visiting Professor Program. The Air Force Institute of Technology (AFIT) at Wright-Patterson Air Force Base, Dayton, Ohio announces the opportunity to join the AFIT graduate faculty as a Distinguished Visiting Professor in the Department of Electrical and Computer Engineering in the School of Engineering. **Responsibilities:** The responsibilities of the AFIT Distinguished Visiting Professor include providing academic leadership in teaching and research in association with AFIT faculty and students, and initiating and conducting research and consultation with the Flight Dynamics Laboratory, Air Force Wright Research and Development Center. **Qualifications:** The person appointed as Distinguished Visiting Professor should be an eminent faculty member at a prestigious university. Selection will be based upon the individual's experience, proposed teaching program and research areas. Areas of special interest and activity at AFIT are: Flight Control Systems, Control Systems for Reconfigurable Aircraft, Design of Robust Multivariable Control Systems, Quantitative Feedback Theory Design, Output Digital Feedback Design Technique for Multivariable Tracking Systems, H_∞ Control Theory, and Adaptive Control and Estimation. Applicants are expected to have a Ph.D. and be a professional contributor in the area of flight control. Consideration will be given to applicants who have extensive flight control experience within industry and government. **Research Support:** Two powerful hybrid computers (EAI SIMSTARS) are the heart of AFIT's flight control laboratory. A high fidelity, full flight envelope, real-time aircraft simulator is developed for academic and research use. Overall, AFIT's computer resources equal or exceed those found at other universities. An office, laboratory, the use of modern computers and other service support will be provided for the visiting professor and may include support for a limited number of the visiting professor's doctoral students. **Period of Appointment and Salary:** The initial period of appointment is for one full year. A shorter period and the starting date are negotiable, but should be prior to October 1, 1991. Extension for a second year may be possible. Salary is commensurate with qualifications. A per diem allowance is also paid. **Application:** A resume of qualifications and experience, including a list of significant publications and any need for support of Ph.D. students can be submitted anytime prior to March 31, 1991 to: Dr. Charles J. Bridgman, Associate Dean for Research, School of Engineering (AFIT/ENR), Air Force Institute of Technology, Wright-Patterson AFB OH 45433-6583, Phone: (513) 255-3633. The Flight Control Distinguished Visiting Professor Program is made possible through a grant from the Air Force Wright Research and Development Center's Flight Dynamics Laboratory. AFIT is an Equal Opportunity/Affirmative Action Employer.

KENT STATE UNIVERSITY
Department of Mathematical Sciences

Applications are invited for a tenure-track faculty position in mathematics at the assistant professor level beginning Fall Semester 1991. Applicants must have completed the requirements for a Ph.D. in mathematics by August 1990. All mathematics research areas will be considered. Salary is competitive and negotiable. The Department of Mathematical Sciences at Kent State University houses pure and applied mathematics, statistics, computer science, and the Institute for Computational Mathematics. Particular strengths in mathematical research in the department include several areas of analysis and algebra. Active areas of computer science research include theoretical computer science, computer algebra and scientific computing.

The department operates a computer laboratory including a significant workstation network, and Encore, Sequent, STARAN, and WARP parallel-processing computers, and a variety of peripherals. The University maintains an IBM 3090 mainframe and a high-performance (interactive) link to the Cray Y-MP/864 at the Ohio Super Computer Center, on which computing time is readily available.

Application deadline is February 15, 1991. Applicants should submit a curriculum vitae, and arrange to have three letters of recommendation sent to Per Enflo, Head of Search Committee, Department of Mathematical Sciences, Kent State University, Kent, OH 44242. Kent State University is an Affirmative Action/Equal Opportunity Employer. Women and minorities are encourged to apply.

KENT STATE UNIVERSITY
Department of Mathematical Sciences
Senior Position in Applied Mathematics/Scientific Computation

Applications are invited for a faculty position at the associate or full professor level beginning Fall Semester 1991 (or earlier). The ideal candidate would have strong training in classical/modern applied mathematics with extensive experience in large-scale scientific computation. He/she would be expected to have a solid record of research, publication, and external funding, as well as a commitment to quality teaching at the undergraduate and graduate level. The appointed faculty member would be expected to enhance the Department's outreach and interdisciplinary research efforts, supervise graduate students, and contribute to curricular planning and development.

The Department of Mathematical Sciences at Kent State University comprises pure and applied mathematics, statistics, computer science, and the Institute for Computational Mathematics. This position is designed to complement existing strengths in applied analysis (especially numerical analysis and approximation theory) and computer science (especially symbolic computation, expert systems, and parallel computing).

The infrastructure of the Department is very good: the equipment inventory includes a significant workstation network plus Encore, Sequent, Staran, and Warp parallel-processing computers and a variety of peripherals. The University also maintains an IBM 3090 mainframe and a high-peformance (interactive) link to the Cray Y-MP/864 at the Ohio Super Computer Center, on which computing time is readily available.

Application deadline is February 8, 1991. If the position is not filled by February 8, 1991, the deadline will be extended until the position is filled, or until April 26, 1991, whichever occurs first. Applicants should submit a resume and arrange to have three letters of recommendation sent to O. P. Stackelberg, Chair, Department of Mathematical Sciences, Kent State University, Kent, OH 44242. Kent

State University is an Affirmative Action/Equal Opportunity Employer.

MIAMI UNIVERSITY, OXFORD, OHIO
Mathematics Education Position
Department of Mathematics and Statistics

Tenure-track assistant professorship beginning August 1991, in the area of mathematics education. Duties include teaching 8-9 hours per semester, continuing scholarship and service. Applicants should have (by 8/91) a doctorate in mathematics education or a doctorate in mathematics with expertise in mathematics education. Please send vita, transcripts and three reference letters to John Skillings, Math Education Search, Department of Mathematics and Statistics, Miami University, Oxford, Ohio 45056. Review of applications will commence on January 15, 1991. Women and minorities are encouraged to apply. Miami provides equal opportunity in employment and education.

THE OHIO STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics of The Ohio State University hopes to have available several positions, both visiting and permanent, effective Autumn Quarter 1991. Candidates in all areas of applied and pure mathematics, including those with demonstrated interest in pedagogical matters, 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 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 resumes will begin immediately.

The Ohio State University is an Equal Opportunity/Affirmative Action employer. Qualified women and minority candidates are encouraged to apply.

THE OHIO STATE UNIVERSITY
Department of Mathematics
Research Instructorships in Mathematics

The Department of Mathematics of The Ohio State University hopes to have available a few research instructor positions for the academic year 1991-92. Candidates should hold a Ph.D. (or equivalent) in mathematics and show strong research promise.

Please send credentials and have letters of recommendation sent to Professor Dijen Ray-Chaudhuri, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, Ohio 43210. The Ohio State University is an Equal Opportunity/Affirmative Action Employer.

OHIO UNIVERSITY
Department of Mathematics

The Department of Mathematics anticipates the appointment of one tenure-track assistant, associate or full professor beginning September 1, 1991. Salary (at least $30,000) and rank dependent on candidate's qualification and experience. Applicants must have a Ph.D. in Mathematics before September 1, 1991 and have research interests in general topology and/or set theory. Only exceptionally well-qualified individuals will be considered for the associate or full professor rank. Send resume and have three letters of recommendation sent to Shih-liang Wen, Chairman, Department of Mathematics, Ohio University, Athens, Ohio 45701. The deadline for applications is January 1, 1991.

Ohio University is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CINCINNATI
Department of Mathematical Sciences
Cincinnati, Ohio 45221-0025

Two tenure-track Assistant Professorships plus the Otto Szasz Assistant Professorship (a one or two year terminal appointment for a new or recent Ph.D. recipient) in areas to be determined among existing research groups in the department are available for September 1991. The Harris Hancock Assistant Professorship (a one or two year terminal appointment for a new or recent Ph.D. recipient) in selected areas of nonlinear analysis (Dynamical Systems, Partial Differential Equations, Numerical Analysis) is also available. Other visiting positions may become available.

All positions require the Ph.D. and strong potential for quality research and teaching. Send curriculum vitae and direct three letters of recommendation to David Minda, Head. UC is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF DAYTON

The Department of Mathematics expects to have two positions, subject to budgetary confirmation, available beginning in August 1991: one tenure-track and one temporary. Applicants should have the Ph.D. by August 1991, and must have a strong commitment to teaching and research. Preference for the tenure-track position will be given to an applicant in applied mathematics who has a background in numerical analysis. Closing date is January 15, 1991. Please send vita, transcript, and arrange for three reference letters to be sent to Dr. T. E. Gantner, Chair, Department of Mathematics, University of Dayton, Dayton, Ohio 45469-2316. UD is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF TOLEDO
Department of Mathematics
Toledo, OH 43606

Applications are invited for a tenure-track assistant professor position beginning in September 1991. Applicants should have a Ph.D. (or have completed all requirements for the Ph.D. by Fall 1991) and be committed to excellence in both teaching and research. Minority and women candidates are particularly encouraged to apply. Applicants should send a resume and arrange for three letters of reference to be sent to Harvey Wolff, Chairman, Department of Mathematics, The University of Toledo, Toledo, OH 43606. The University of Toledo is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF TOLEDO
Department of Mathematics
Toledo, OH 43606

Applications are invited for a visiting assistant professor position beginning in September 1991. Applicants should have a Ph.D. (or have completed all requirements for the Ph.D. by Fall 1991) and be committed to excellence in both teaching and research. Applicants should send a resume and arrange for three letters of reference to be sent to Harvey Wolff, Chairman, Department of Mathematics, The University of Toledo, Toledo, OH 43606. The University of Toledo is an Equal Opportunity/Affirmative Action Employer.

OKLAHOMA

OKLAHOMA STATE UNIVERSITY
Department of Mathematics

Several tenured, tenure-track and visiting positions at all professorial ranks are anticipated for Fall 1991. All areas are under consideration, but we especially encourage applications in Differential Geometry, Partial Differential Equations, Probability, Algebraic Geometry, Topology, Several Complex Variables, Harmonic Analysis, Non-linear Analysis, Numerical Analysis and Optimization Theory. Normal duties include research and at most six hours teaching per semester. Minimum qualifications are a Ph.D. in Mathematics or a related field, evidence of research achievement or potential, and a commitment

to teaching. Post-doctoral experience is desirable, but not essential. For full consideration, send a resume and arrange to have three confidential letters of reference sent by January 15, 1991 to Bruce Crauder, Appointments Committee Chairman, Department of Mathematics, Oklahoma State University, Stillwater, OK 74078-0613. O.S.U. is an Equal Opportunity/Affirmative Action Employer. Women and minorities are especially encouraged to apply.

OKLAHOMA STATE UNIVERSITY
Department of Mathematics
Department Head

The Department invites applications and nominations for the position of Department Head, starting July 1, 1991. Rank and salary are dependent on qualifications. Candidates must have a Ph.D., or equivalent degree, a strong research record, and a commitment to excellent teaching. Oklahoma State University is a comprehensive research university with an enrollment of about 20,000. The Department has 30 faculty members and offers bachelor, masters and doctoral degree programs. For full consideration send a vita and three letters of reference by December 15, 1990 to Search Committee, Department of Mathematics, Oklahoma State University, Stillwater, OK 74078. Applications by women and minorities are encouraged. Oklahoma State University is an Affirmative Action/Equal Opportunity Employer.

THE UNIVERSITY OF OKLAHOMA
Department of Mathematics
601 Elm Avenue, Room 423
Norman, Oklahoma 73019-0315

Applications are invited for two anticipated tenured or tenure-track positiions in Mathematics beginning Fall 1991. One position at the associate professor level, with preference given to applicants with research interests in the areas of Geometry, Topology, or Analysis. One Assistant Professor position at the entry level with preference given to research interests compatible with those of our current faculty. Candidates must have a Ph.D. degree, demonstrated excellence in research, and a strong commitment to high-quality teaching. Duties include research, normally teaching six credit hours per semester, and Departmental and University service appropriate to rank. Salary will be commensurate with qualifications and experience. There may also be visiting positions. Applicants should send their vita and have at least three letters of reference sent to Dr. Ruediger Landes, Search Committee Chair, Department of Mathematics, University of Oklahoma, 601 Elm Avenue, Room 423, Norman, Oklahoma 73019-0315. Initial screening begins December 15, 1990 and every two weeks thereafter. Applications will be accepted until the positions are filled. The University of Oklahoma is an Equal Opportunity/Affirmative Action Employer. OU has a policy of being responsive to the needs of dual-career couples.

OREGON

GOOD SAMARITAN HOSPITAL
& MEDICAL CENTER
2169 N.W. Northrup
Portland, OR 97210

Self-structured postdoctoral fellowship is offered for a Ph.D., in Mathematics or Mathematical Physics at the R. S. Down Neurological Sciences Institute in Portland, Oregon. We are looking for a researcher who is interested in professional freedom, developing their own interests, and asking such questions as: How does an organism simplify its movement task and how are those simplifications reflected in ensemble activity of neurons? As part of an established theoretical project, the fellow will have the opportunity to develop appropriate mathematical formalism, then elaborate the structure of the resulting mathematics and explore the empirical consequences. This position offers ongoing collaboration with both experimental and clinical neuroscientists as well as clinical links to a major medical center. Please send research interests, vitae and three reference letters to the Human Resources Management Department. AA/EOE.

PENNSYLVANIA

BRYN MAWR COLLEGE
Department of Mathematics

Bryn Mawr College invites applications for a tenure track assistant professorship in Mathematics, to start September 1991. Candidates should have a doctorate in a mathematical science, or expect to have completed it by Sept. 1, 1991. Candidates are expected to show promise in research and a commitment to teaching. All fields are acceptable, with a preference for algebra or applied mathematics. Bryn Mawr is an Equal Opportunity/Affirmative Action employer, and seeks faculty and staff knowledgable about and concerned with multicultural and international issues. Minority candidates and women are especially encouraged to apply. Closing date January 1, 1991. (Late applications may be considered.) Send application and three letters of recommendation to:

Search Committee
Department of Mathematics
Bryn Mawr College
Bryn Mawr, PA 19019

Telephone: (215)526 5348.
Email: MSEARCH@BRYNMAWR.

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 1991, 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 arrange to have three letters of recommendation sent to the Appointments Committee, send a vita, a list of publications and a statement describing current and planned research. It is important that the latter explain the relation of the proposed work to that currently done in the Department. All communications should be addressed to: Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

CARNEGIE MELLON UNIVERSITY
Department of Mathematics

The Department expects to make one tenure-track appointment, to begin in the Fall of 1991, at the Assistant Professor level. We particularly seek candidates in the area of computational mathematics, but also will consider other areas of research which strongly intersect those of the current faculty of the Department. Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have at least 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. Carnegie Mellon University

is an Affirmative Action/Equal Opportunity Employer.

CARNEGIE MELLON UNIVERSITY
Department of Mathematics

The Department expects to make at least one Post-Doctoral appointment for 1991-1992 in the area of applied analysis. The is a one-year (twelve-month) appointment. Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have at least 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. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

EBERLY COLLEGE OF SCIENCE
AT PENN STATE UNIVERSITY

Department Head and Professor, Department of Mathematics, Penn State. The Eberly College of Science at Penn State University invites applications and nominations for the position of Head of the Department of Mathematics.

Candidates for the position of Head of the Department of Mathematics should have a distinguished record of mathematical research and teaching appropriate for appointment as full Professor. They should have demonstrated superior administrative or leadership skills, qualifying them to play a key role in the further development of the Department.

Applications and nominations received by December 1, 1990, will be given full consideration. Later submissions will be accepted until the position is filled. Nominations and applications (including a current curriculum vitae, publication list, and the names, addresses and telephone or email numbers of at least three references) should be sent to: Chairman, Search Committee for a Mathematics Department Head, Box Mn, 211 Whitmore Building, Penn State University, University Park, PA 16802. An Affirmative Action/Equal Opportunity Employer. Women and Minorities Encouraged to Apply.

HAVERFORD COLLEGE, MATHEMATICS
Haverford, PA 19041

Haverford College announces a tenure-track opening for 1991-92 in the Department of Mathematics, at the Assistant (or possibly Associate) Professor level. Applications are invited from candidates with research interests in any field of mathematics. Candidates should demonstrate a strong commitment to teaching a broad spectrum of undergraduate courses, and to research. Send curriculum vitae, statement of research and teaching interests, and three letters of recommendation to: Curtis Greene, Chair, Department of Mathematics, Haverford College, Haverford, PA 19041. Haverford College is an Equal Opportunity/Affirmative Action Employer. Women and minority candidates are encouraged to apply. **Deadline for applications: December 7, 1990** (Late applications may be considered until the position is filled, but this cannot be guaranteed.)

MILLERSVILLE UNIVERSITY OF PA

Mathematics Department. Tenure-track Assistant Professor in Mathematics beginning August, 1991. Duties include teaching upper and lower division undergraduate mathematics courses. Must have strong commitment to excellence in teaching and scholarship. Ph.D. in Mathematics or near completion. Candidates with specialty in any field of mathematics may apply; some preference will given to the applied areas. Full consideration will be given to applications received by 1/28/91, but consideration of applications will continue until position is filled. Submit resume, copies of transcripts, and three letters of recommendation (at least two attesting to teaching effectiveness) to Dr. Dorothee Jane Blum, Search Committee/AMS1190, Department of Mathematics, Millersville University, Millersville, PA 17551. An Affirmative Action/Equal Opportunity Employer.

TEMPLE UNIVERSITY
Department of Mathematics
Assistant Professorship

The Mathematics Department anticipates a tenure-track position opening at the junior level beginning Fall 1991. All fields will be considered with preference given to Geometry/Topology, Lie Theory, Nonlinear PDE's, and Number Theory. Vita and three letters of reference should be sent by December 31, 1990 to Search Committee, Department of Mathematics, Temple University, Philadelphia, PA 19122.

Women and Minorities are especially encouraged to apply. Temple University is an Affirmative Action/Equal Opportunity Employer.

Email: search@euclid.math.temple.edu

UNIVERSITY OF PITTSBURGH
Department of Mathematics and Statistics

The department invites applications for the following positions, which will be available for September 1991 if funding permits.

1. Assistant Professor in the area of partial differential equations.

2. Assistant Professor in some branch of pure mathematics other than differential equations. Applicants are especially encouraged in algebra and geometric or algebraic topology, but all areas will be considered.

Requirements include outstanding research accomplishment and potential commensurate with experience, and ability and interest in excellent teaching.

Applicants should send resume and arrange to have at least three letters of recommendation sent to: S. Hastings, Chairman, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA 15260.

The University of Pittsburgh is an Equal Opportunity/Affirmative Action Employer. Women and minorities are especially encouraged to apply.

THE UNIVERSITY OF SCRANTON
Mathematics Department

The University of Scranton is a Jesuit university with over 3,500 undergraduates. The Mathematics Department has 15 full-time faculty and about 50 majors.

One (possibly two) tenure-track position is available for Fall 1991 for faculty interested in a teaching environment where research is encouraged and supported. Individuals with expertise in any area of mathematics will be considered. Preferred areas include Applied Mathematics, Probability/Statistics, Actuarial Mathematics, Algebra, and Analysis. Rank and salary are open and competitive.

Submit a vita, transcripts, and three references to Mathematics Faculty Search Committee, University of Scranton, Scranton, PA 18510 or phone (717) 941-6113. Screening will begin at once and applications will be considered until all positions have been filled. An AA/EO Employer and Educator.

SOUTH CAROLINA

COLLEGE OF CHARLESTON
Department of Mathematics

Applications are invited for at least 2 tenure-track positions at the Assistant Professor level beginning August 1991. Candidates must have a Ph.D. in one of the mathematical sciences, a commitment to undergraduate teaching, and potential for continuing research. The normal teaching load is 9 hrs/wk, with possibilities for reductions through internal grants.

The salary is competitive. Applicants should send a vita and have three letters of recommendation sent to William L. Golightly, Chairman, Department of Mathematics, College of Charleston, Charleston, SC 29424. The process of evaluating applications will begin on January 21, 1991, but applications will be considered until the positions are filled. The College of Charleston is an Affirmative Action/Equal Opportunity Employer.

FURMAN UNIVERSITY
Greenville, South Carolina 29613

The Department of Mathematics at Furman University, an undergraduate, liberal arts college, invites applications for a tenure-track Assistant Professorship beginning September 1, 1991. A Ph.D. in a mathematical science is required. All areas of specialization are acceptable. Excellence in teaching and continued scholarly activity are expected of all faculty. A vita, graduate and undergraduate transcripts, and three letters of recommendation should be sent to Robert Fray, Department of Mathematics. Application deadline: February 1, 1991. EOE/AAE

THE UNIVERSITY OF SOUTH CAROLINA
Department of Mathematics

Applications are invited for anticipated tenure-track faculty positions at all ranks. Applications in all areas of mathematics will be considered. The department is building on existing research strengths and is increasing the scope of its programs in applied mathematics. The Ph.D. degree or its equivalent is required, and all appointments will be consistent with the department's commitment to excellence in research and teaching at the graduate and undergraduate levels. A resume, containing a summary of research accomplishments and goals, and four letters of recommendation should be sent to:

Dr. Colin Bennett, Chairman
Department of Mathematics
University of South Carolina
Columbia, South Carolina 29208

The closing date for applications is January 31, 1991. The University of South Carolina is an Affirmative Action/Equal Opportunity Employer.

TENNESSEE

UNIVERSITY OF TENNESSEE
AT CHATTANOOGA
Department Head

The University of Tennessee at Chattanooga invites applications for Head of the Department of Mathematics. A Ph.D. in a mathematical science and at least five years of college mathematics teaching experience are required. Applicants should provide evidence of leadership in curriculum development, teaching, public service and research/scholarly activities. In this primarily undergraduate institution, the faculty is expected to exhibit excellence in teaching while maintaining a strong commitment to research and public service. The mathematics department has 21 faculty members including a Chair of Excellence in applied mathematics. Located in a very scenic metropolitan area of 400,000, UTC has a student enrollment of 7800. Send applications with current vita to: Dr. Paul L. Gaston, Dean, College of Arts and Sciences, 119 Holt Hall, UTC, Chattanooga, TN 37403-2598. Applications received by January 31, 1991, will be assured full consideration. Women and minorities are encouraged to apply. UTC is an Equal Opportunity Employment/Affirmative Action/Title IX Section 504 Institution.

UNIVERSITY OF TENNESSEE

The Mathematics Department of the University of Tennessee, in an effort to significantly improve its research position, seeks to fill a tenure-track assistant professorship or junior associate professorship. Employment begins August 1991. The Department's interests are in the areas of algebra, analysis, applied mathematics, differential equations, geometry, mathematical ecology, numerical analysis, probability, and topology. Substantial research accomplishments and promise, as well as dedication to teaching are paramount. Interested applicants should arrange to have a vita, three reference letters, and a research statement sent to Professor John B. Conway, Mathematics, University of Tennessee, Knoxville, TN 37996-1300. Review of applications will begin December 1 and will continue until the position is filled.

UTK is an EEO/AA/Title IX/Section 504 Employer.

UNIVERSITY OF TENNESSEE

Position Available. Assistant/Associate professor of Mathematics and Ecology, The University of Tennessee, Knoxville. A tenure-track joint appointment in the Department of Mathematics and the Graduate Program in Ecology is available starting fall 1991. Appointee is expected to interact with a large group of mathematical and theoretical ecologists at UTK and Oak Ridge National Laboratory (Environmental Sciences Division), have or establish an active research program, teach a variety of undergraduate and graduate courses in mathematics, and lead graduate seminar courses in the Ecology Program. A Ph.D. in mathematics, ecology, or related area is required as well as previous teaching experience. Area of expertise in mathematical ecology is open. Submit a c.v., transcripts, brief plan of future research, and have three letters of recommendation sent to Dr. Thomas G. Hallam, Chair, Math Ecology Search Committee, Department of Mathematics, University of Tennessee, Knoxville, TN 37996-1300. Review of applications will begin December 31, 1990 and will continue until the position is filled. UTK is an EEO/AA Title IX/Section 504 Employer.

VANDERBILT UNIVERSITY
Department of Mathematics
1326 Stevenson Center
Nashville, TN 37240

ASSISTANT PROFESSOR.
Specialization in approximation theory, computer-aided design, or numerical analysis. This position is intended for a person whose primary research involves computing. It is an initial 3 year appointment beginning Fall 1991. It is renewable and tenure-track. Outstanding research potential and evidence of effective teaching is required. Have vita and 4 letters of recommendation (including one about teaching) sent to Professor Glenn Webb, Chairman.

Vanderbilt University is an Equal Opportunity/Affirmative Action Employer.

VANDERBILT UNIVERSITY
Department of Mathematics
1326 Stevenson Center
Nashville, TN 37240

ASSISTANT PROFESSOR.
Specialization in topology. Initial 3 year appointment beginning Fall 1991 (renewable; tenure-track). Outstanding research potential and evidence of effective teaching required. Have vita and 4 letters of recommendation (including one about teaching) sent to Professor Glenn Webb, Chairman.

Vanderbilt University is an Equal Opportunity/Affirmative Action Employer.

VANDERBILT UNIVERSITY
Department of Mathematics
1326 Stevenson Center
Nashville, TN 37240

ASSISTANT PROFESSOR.
Ph.D. required with two year appointment beginning Fall, 1991. This is not a tenure-track appointment but is intended for a person with demonstrated research potential who would like to spend time in a department with a vigorous research atmosphere. We are especially interested in someone who works in one

of the areas of departmental strengths which include universal algebra, differential equations, approximation theory, operator theory, mathematical biology, applied mathematics, graph theory, and topology. Have vita and four letters of recommendation (including one about teaching) sent to Professor Glenn Webb, Chairman.

Vanderbilt University is an Equal Opportunity/Affirmative Action Employer.

TEXAS

SOUTHERN METHODIST UNIVERSITY
Department of Mathematics

The Department of Mathematics at Southern Methodist University invites applications for a tenure-track position, to be filled at senior or junior level, with employment beginning in Fall 1991. Applicants must be active researchers in applied or numerical mathematics, must have a strong commitment to undergraduate teaching and must be able to contribute to the doctoral program in applied mathematics, numerical analysis and scientific computation. Candidates for a senior position should have an outstanding reseach record in applied mathematics, a successful grant record and experience in advising doctoral students. The standard teaching load is two courses (six hours) per semester. A visiting position may also be available.

Departmental research interests include fluid mechanics, asymptotic and perturbation methods, nonlinear waves, bifurcation theory, combustion theory, dynamical systems, mathematical biology, numerical analysis of differential equations and mathematical software. Thirteen of the sixteen faculty are applied or numerical mathematicians. Senior faculty include D. H. Anderson (mathematical biology), W. E. Ferguson (numerical partial differential equations), I. Gladwell (mathematical software), R. Haberman (nonlinear waves), G. W. Reddien (bifurcation theory), D. A. Reinelt (fluid mechanics) and L. F. Shampine (numerical ordinary differential equations). Southern Methodist University has a 20 processor Sequent Symmetry for research use.

The application deadline is January 15th, 1991. Send a letter of application and a vita to: Professor I. Gladwell, Chairman, Department of Mathematics, Southern Methodist University, Dallas, Texas 75275 (Tel: (214) 692-2506). Applicants for a junior position should also arrange for three letters of recommendation to be sent to Professor Gladwell.

SMU is an equal opportunity/affirmative action/Title IX employer.

I. Gladwell's email addresses:
gladwell@csvax.seas.smu.edu
H5NR1001@SMUVM1.BITNET

UNIVERSITY OF HOUSTON
Department of Mathematics
M. D. Anderson Chair

The department seeks nominations or applications for the M. D. Anderson Professorship in Mathematics.

Applicants for this endowed professorship should have an outstanding record of research and scholarly achievement, a commitment to excellence in teaching, and demonstrated scientific leadership. Applications are welcome from candidates specializing in any area of pure or applied mathematics. However, special consideration will be given to mathematicians whose research interests are consonant with those of the present faculty. The department will start the selection process in mid-December, 1990.

Inquiries, nominations and applications should be sent to:

Garret J. Etgen, Chair
Department of Mathematics
University of Houston
Houston, TX 77204-3476
(Ph: 713-749-4827 FAX: 713-749-4626)

Applicants should include a curriculum vita and suggest possible references.

The University of Houston is an equal opportunity/affirmative action employer.

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Mathematics
Austin, Texas 78712

Openings are expected for Fall 1991 at all levels, including Instructor (customarily appointees are new Ph.D.s), Assistant Professor (customarily appointees have at least two years' experience beyond the Ph.D.), Associate Professor, and Professor. Candidates should have outstanding research ability and concern for teaching. Salaries are competitive. If you have access to email, request a form from **recruit@math.utexas.edu.** Otherwise, please send vita, detailed summary of research interests, and three recommendation letters to address above, directed as follows:

Instructor and Assistant Professor: c/o Recruiting Committee

Associate Professor and Professor: c/o John Dollard, Chairman

The University of Texas at Austin is an equal opportunity employer. Minorities and women are encouraged to apply.

UTAH

BRIGHAM YOUNG UNIVERSITY
Department of Mathematics

A senior position is available for a suitable candidate who has a strong research record in analytic number theory. The appointment will be at the full Professor level. A successful candidate should be a recognized leader in this specialty.

Applications will be accepted until 10 January 1991. Please send a curriculum vitae and have three letters of reference sent to:

Donald W. Robinson
292 TMCB
Brigham Young University
Provo, UT 84602

BYU is an Equal Opportunity/Affirmative Action Employer.

BRIGHAM YOUNG UNIVERSITY
Department of Mathematics

Applications are invited for two positions, one in each of two specialties: nonlinear PDE/infinite dimensional dynamical systems, and geometric topology/geometric combinatorial group theory.

Selections will be based upon a proven record of research and teaching ability. Applications will be accepted until 1 February 1991. Please send a curriculum vitae and have three letters of reference sent to:

Donald W. Robinson
292 TMCB
Brigham Young University
Provo, UT 84602

BYU is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF UTAH
Department of Mathematics

invites applications for the following positions:

1. At least 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 1990. Selection

will be based on research expertise and teaching ability.

2. Two or more nonrenewable **three-year Instructorships**. Persons of any age receiving Ph.D. degrees in 1990 or 1991 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be $31,500; 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 $35,500. Duties consist of teaching four courses during the three quarter academic year.

4. One of 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.

Applications will be accepted until January 31, 1991 or until the 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, University of Utah, Salt Lake City, Utah 84112. The University of Utah is an equal opportunity-affirmative action employer.

VERMONT

UNIVERSITY OF VERMONT
Position in Applied Mathematics

The Department of Mathematics and Statistics solicits nominations and applications to fill a tenure-track Assistant Professor position in applied mathematics. Applicants should have a Ph.D. in Mathematics or a related discipline and demonstrated excellence in research and teaching. Research interests should be compatible with existing groups in fluid dynamics, structural mechanics, and biomedical mathematics. Experience in modeling, computation, and interdisciplinary research is desirable. Duties include teaching two courses per semester and conducting research. Salary is competitive and commensurate with qualifications and experience. Applicants should send a vitae, description of research, and three letters of reference to: Personnel Committee, Department of Mathematics and Statistics, University of Vermont 05405-3357. The deadline for applications is January 15, 1991; duties begin in the Fall Semester 1991. UVM is an Equal Opportunity/Affirmative Action Employer. Minorities and women are strongly encouraged to apply.

VIRGINIA

MARY WASHINGTON COLLEGE
Department of Mathematics
Assistant Professor in
Mathematics Education

Applications are invited for a tenure-track position effective 8/15/91. Candidates should have a Ph.D. in Education with an M.S. (or M.A.) in mathematics. The responsibilities include teaching four courses per semester (one of which is history of mathematics); leading the "outcomes assessment" program for the department; working with elementary and secondary teachers to coordinate teacher re-certification and in-service programs; seeking grants to enhance education in mathematics; and advising the department on using computers to aid instruction. Send vita to:

Betty Durrer
Chair of the Search Committee
Dept. of Mathematics
Mary Washington College
Fredericksburg, VA 22401

The search will be closed by January 31, 1991. Mary Washington College is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF VIRGINIA
Lawrence E. Thomas
Department of Mathematics
Charlottesville, Virginia 22903

The Department of Mathematics is seeking an outstanding candidate to fill its Whyburn Instructorship. Applicants should show exceptional promise in teaching and research. Preference is to be given to applicants who have received the Ph.D. within the past two years and who are working in algebra. The Instructorship is a two-year appointment with reduced teaching load and partial summer support.

The University of Virginia is an Equal Opportunity/Affirmative Action Employer.

WASHINGTON

EASTERN WASHINGTON UNIVERSITY
Department of Mathematics

Applications are being accepted for two probationary, tenure-track assistant professor positions to begin September 1, 1991. Persons with a strong and broad background in algebra and topology are urged to apply. A Ph.D. in mathematics is required. Teaching experience and an interest in industrial applications are desirable. The Mathematics Department seeks to strengthen its MS, MEd and undergraduate programs, as well as its ties to local industry. Review of applications will begin February 1, 1991 and continue until the positions are filled. Applicants should send a letter of application stating objectives and philosophy in teaching and research, a curriculum vita with graduate transcripts and names, address and phone number of three references to: Dr. Ronald H. Dalla, Chairman, Mathematics Department, MS 32, Eastern Washington University, Cheney, WA 99004. AA/EOE

WESTERN WASHINGTON UNIVERSITY

Applications are invited for tenure-track and visiting positions to begin Fall 1991. Successful candidates will be expected to be active in research, to interact at the research level with current department members, and to be effective teachers with a commitment to both undergraduate and graduate education.

Candidates in the following areas of mathematics are especially sought: discrete mathematics (particularly graph theory), modeling, optimization, and statistics. A Ph.D. is required.

A demonstrated interest in the use of computers for instructional purposes and in the integration of applications of mathematics into classroom material is desirable.

Rank and salary are open, but a substantial research record will be required for appointments above the Assistant Professor level. The normal teaching load for research faculty is two courses per quarter.

Western Washington University is located on Bellingham Bay in an area of outstanding natural beauty within an hour's drive of the Seattle and Vancouver, B.C., metropolitan areas and the Cascade Mountains. The department has a strong undergraduate program with a somewhat applied flavor and a flourishing Master's program with about twenty students.

Applications should be sent to Professor Thomas T. Read, Chairman, Department of Mathematics, Western Washington University, Bellingham, WA 98225-9063.

Interested candidates should submit a letter of application, complete transcripts, a vita, and three letters of recommendation addressing the candidate's qualifications in teaching and research. Deadline for applications is February 1, 1991; later applications will be considered if positions remain available. Positions are subject to the continuing

availability of funds. The University is an EO/AA employer.

WEST VIRGINIA

WEST VIRGINIA UNIVERSITY
Department of Mathematics

The Department of Mathematics intends to make several faculty appointments that will commence August 1991. One appointment may be at the Associate rank; others will be at the Assistant rank. Candidates are expected to have a Ph.D. in mathematics or equivalent with a strong record or demonstrated potential in both research and teaching. Preference will be given to applicants whose research interests complement those currently in the Department in algebra, analysis, applied or numerical analysis, discrete mathematics. Normal responsibilities include research and a two course teaching assignment per semester at the graduate or undergraduate level. Applications and inquiries should be directed to James Lightbourne, Department of Mathematics, West Virginia University, Morgantown, WV 26506. Applicants should submit a vita and have three letters of reference sent (senior applicants may choose to submit names of references). To insure consideration, application materials must be received by January 15, 1991. WSU is an Affirmative Action/Equal Opportunity Employer. Qualified women and minorities are especially encouraged to apply.

WISCONSIN

LAWRENCE UNIVERSITY
Appleton, Wisconsin 54912
Department of Mathematics

We will have at least two tenure-track positions, starting September 1991. Teach two courses per ten week term (three terms per year), engage in research and scholarship. Lawrence is a highly selective liberal arts college with 1200 students. Send cover letter indicating particular interest in liberal arts setting, graduate transcript, vita, and three letters of recommendation (one of which must relate first-hand evidence of exceptional teaching ability) to Alan E. Parks, Chair. Closing date: January 1, 1991. Lawrence promotes equal opportunity in employment for all. Women and minorities encouraged to apply.

UNIVERSITY OF WISCONSIN - MADISON
Department of Mathematics
Employment Opportunities

The Department of Mathematics at the University of Wisconsin-Madison solicits applications for the following positions to begin fall 1991.

Tenure and Tenure-Track Positions. Appointments will be made at the Assistant Professor level unless qualifications and experience require appointment at higher rank—in geometry, nonlinear P.D.E., and other areas of programmatic need. Deadline for applications is November 30,1990.

Van Vleck Assistant Professorships. Appointments are for a specified term of three years at an academic year salary of at least $33,000. The usual teaching load is two courses per semester. Ordinarily only those applicants who have received their doctorate since 1988 and prior to September 1991 will be considered. Preference will be given to candidates who are likely to interact well with other members of Department. Deadline for applications is December 31, 1990.

Candidates should provide clear evidence of teaching ability and excellence in mathematical research. Supporting materials should include a vita, and three or recommendation letters, at least one of which discusses, in detail, the candidate's teaching qualifications. Van Vleck applicants are also required to submit a one to three page abstract of their dissertation.

Application forms are available from the Hiring Committee, Department of Mathematics, 223 Van Vleck Hall, 480 Lincoln Drive, Madison, WI 53706. Applications will be accepted for all positions until they are filled; however, in order to ensure full consideration, the application and all supporting materials should be received by the above deadlines. The University of Wisconsin is an AA/EOE employer and encourages women and minorities to apply.

The Immigration Reform and Control Act of 1986 requires the University to verify the identity and work authorization of the successful applicant. Offer of employment is contingent upon verification.

CANADA

UNIVERSITY OF ALBERTA
Department of Mathematics

Applications are invited for a tenure-track position (File GP-1) at the Assistant Professor level, beginning July 1, 1991. The possibility of an appointment at the Associate Professor level is not precluded. Requirements are a Ph.D. and proven ability or demonstrated potential for research and teaching. Salary for Assistant Professors is currently $36,910–$53,374; for Associate Professors currently $45,694–$67,658. Send vitae and arrange for three letters of reference to be sent to: Professor R. Bercov, Chairman, Department of Mathematics, University of Alberta, Edmonton, Alberta, Canada T6G 2G1. In accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. Closing date for applications is January 15, 1991. Please quote file number when responding to this advertisement. The University of Alberta is committed to the principle of equity in employment. The University encourages applications from aboriginal persons, disabled persons, members of visible minorities and women.

UNIVERSITY OF ALBERTA
Department of Mathematics

Applications are invited for a tenure-track position in Numerical Analysis (File NA-1) at the Assistant Professor level, beginning July 1, 1991. The possibility of an appointment at the Associate Professor level is not precluded. Requirements are a Ph.D. and proven ability or demonstrated potential for research and teaching. Salary for Assistant Professors is currently $36,910–$53,374; for Associate Professors currently $45,694–$67,658. Send vitae and arrange for three letters of reference to be sent to: Professor R. Bercov, Chairman, Department of Mathematics, University of Alberta, Edmonton, Alberta, Canada T6G 2G1. In accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. Closing date for applications is January 15, 1991. Please quote file number when responding to this advertisement. The University of Alberta is committed to the principle of equity in employment. The University encourages applications from aboriginal persons, disabled persons, members of visible minorities and women.

UNIVERSITY OF ALBERTA
Department of Mathematics

Applications are invited for a tenure-track position in Approximation Theory (File AP-1) at the Assistant Professor level, beginning July 1, 1991. The possibility of an appointment at the Associate Professor level is not precluded. Requirements are a Ph.D. and proven ability or demonstrated potential for research and teaching. Salary for Assistant Professors is currently $36,910–$53,374; for Associate Professors currently $45,694–$67,658. Send vitae and arrange for three letters of reference to be sent to: Professor R. Bercov, Chairman, Department of Mathematics, University of Alberta, Edmonton, Alberta, Canada T6G 2G1. In accordance with Canadian Immi-

gration requirements, priority will be given to Canadian citizens and permanent residents of Canada. Closing date for applications is January 15, 1991. Please quote file number when responding to this advertisement. The University of Alberta is committed to the principle of equity in employment. The University encourages applications from aboriginal persons, disabled persons, members of visible minorities and women.

UNIVERSITY OF TORONTO
Department of Mathematics

Applications are invited for one or possibly two limited term Assistant Professorships, from July 1, 1991 to June 30, 1994. Duties consist of teaching and research, and candidates must demonstrate clear strength in both. Applications, including a complete curriculum vitae, should be sent to Professor J. Repka, Associate Chairman, Department of Mathematics, University of Toronto, Toronto, Canada, M5S 1A1. Applicants should arrange for at least three letters of reference to be sent directly to the Associate Chair; at least one of these should refer to teaching. The deadline for applications is January 15, 1991. In accordance with Canadian immigration requirements priority will be given to Canadian citizens and permanent residents of Canada. The University of Toronto encourages both women and men to apply for positions.

GERMANY

UNIVERSITY OF BIELEFELD
Department of Mathematics

Starting October 1st, 1990, a college for postgraduate and postdoctoral studies in mathematics will be instituted at Universität Bielefeld.

The main areas of research are: finite, discrete and Lie groups, potential theory, representation theory, topology, K-theory, combinatorics, numerical analysis, information theory and statistics.

Further information and application forms may be obtained from: Prof. Dr. Andreas Dress, Fakultät für Mathematik, Universität Bielefeld, Postfach 8640, 4800 Bielefeld 1, West-Germany (Telefax: (0521) 106-4743).

HONG KONG

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Department of Mathematics

The Hong Kong University of Science and Technology is a new publicly funded research University. The first intake of students will be in October 1991 at both undergraduate and graduate levels including the doctorate. Enrollment is expected to grow to 7,000 FTE by 1996-1997. The medium of instruction is English. Applications are invited for the following positions:

Professor: Minimum US$79,600 p.a.
Reader: US$58,200 - US$77,300 p.a.
Senior Lecturer: US$55,800 - US$74,900 p.a.
Lecturer: US$35,900 - US$40,700
BAR US$43,100 - US$60,000 p.a.

The Department will place major emphasis on applications with an appropriate component of pure mathematics to preserve the integrity of the discipline. Research areas will be highly interdisciplinary and will include scientific computation, statistics, fluid and solid mechanics, mathematical physics, analysis, algebra, geometry, etc.

Applicants should have a Ph.D. degree in the relevant fields. Appointees at the senior level are expected to have a distinguished record in research and have demonstrated an ability to develop research programs; appointees at Lecturer level are expected to have outstanding potential to develop research in his/her own fields. Responsibilities include undergraduate and postgraduate teaching not exceeding two courses per semester.

Generous fringe benefits including medical and dental benefits, annual leave, and children's education allowances are provided. Air passages, housing or private tenancy allowance are also provided where applicable. Initial appointments will generally be on a three-year contract which is renewable subject to mutual agreement. A gratuity of an amount equal to 25% of the total basic salary drawn will be payable upon successful completion of contract. It is the intention of the University to introduce a superannuation scheme and arrangements will be made for eligible staff to join the scheme as appropriate. Approved sabbatical leave will be at full salary.

Applications/nominations should be sent with a complete CV together with the names and addresses of at least three references to:

Director of Personnel
The Hong Kong University of Science and Technology
12/F, World Shipping Centre
7 Canton Road
Tsim Sha Tsui
Kowloon, Hong Kong
Fax No.: (852) 735-7806

The search will continue until suitable appointments are made.

NEW ZEALAND

THE UNIVERSITY OF WAIKATO
Hamilton New Zealand
Lecturer in Statistics

The University of Waikato invites applications for a lectureship in Statistics in the Department of Mathematics and Statistics. The Statistics Section of the Department consists of five statisticians who, together with other university staff and statisticians from the nearby Ruakura Agricultural Research Centre, constitute the Waikato Centre for Applied Statistics (WCAS). Also within the WCAS is the Unit for Quality and Productivity Improvement led by Professor J. A. John, in which there is collaboration in research projects and interchange of teaching and consulting.

Applicants for the post should preferably have completed doctoral studies, and have broad active research interests. They should be experienced communicators of statistical ideas and willing to participate fully in our introductory statistics program. Consulting experience is also highly valued.

Current research interests in statistics include Experimental Design, Survey Methodology, Statistical Computation, Dynamic Linear Models, Mixture Models, Generalized Linear Models, Operations Research and Industrial Statistics.

The current salary range for Lecturers is $NZ37,440 - $49,088 per annum.

Enquiries of an academic nature should be made to Professor D. Bridges, telephone (64) 71 562889 or Email: d.bridges@waikato.ac.nz (via Internet).

Information on the method of application and conditions of appointment can be obtained from the Academic Staff Registrar, University of Waikato, Private Bag 3105, Hamilton, New Zealand, telephone (64) 71 562 889, Fax (64) 71 560135. Applications quoting reference number A90/88 close on 7 December 1990.

Places for appointees' children may be available in the creche run by the Campus Creche Society (Inc). The University welcomes applications from suitable people regardless of race, creed, marital status, or disability.

SCOTLAND

UNIVERSITY OF ABERDEEN
Department of Mathematical Sciences
Chair of Applied Mathematics or Statistics

Applications are invited for the position of Professor of Applied Mathematics or Statistics in the Department of Mathematical Sciences. The new Professor will be expected to develop teaching and research in

an area of Applied Mathematics or Statistics. Applicants with a main research interest in Applied Analysis or Operational Research are encouraged but applications from specialists in other areas would be welcome.

Further particulars and application forms are available from the Personnel Office, University of Aberdeen, Regent Walk, Aberdeen AB9 1FX (tel 0224 273500) to whom applications (2 copies) should be returned by 10 December 1990 quoting reference number JA/135.

SOUTH KOREA

KYUNGPOOK NATIONAL UNIVERSITY

We anticipate positions available at the Assistant Professor level beginning March 1991. Candidates should have outstanding research ability in Geometry and must speak Korean fluently.

Enquiries may be directed to:
Chang-Young Park
Department of Mathematics
College of Natural Sciences
Kyungpook National University
Taegu, 702-701, South Korea
Phone: Korea-53-950-5312

JOURNALS FOR SALE

American Math. Monthly, Bulletin of AMS, from 1961, bound volumes. An invaluable resource for scholars and libraries. Send request for detailed information to Dr. Bert Ross, Univ. of New Haven, West Haven, CT 06516.

PUBLICATIONS WANTED

Wanted: Mathematical books, journals, reprints, ephemera. Contact R. K. Dennis, Math. Dept., White Hall, Cornell U., Ithaca, NY 14853-7901. Tel: 607-255-4027, FAX: 607-255-7149. e-mail:
dennis@mssun7.msi.cornell.edu

Due to the present crisis in Kuwait, Professor S. A. Naimpally has moved to 121 Medhurst Drive, Nepean, Ontario, K2G 4J9, Canada. Since he has lost his library in Kuwait, he requests topologists to send him preprints and reprints in function spaces, hyperspaces, proximity, generalized metric spaces, noncontinuous functions, uniform spaces and related topics.

Festschrift in honor of **I. I. PIATETSKI-SHAPIRO**, Parts I-II

S. Gelbart, R. Howe and P. Sarnak, Editors
Israel Mathematical Proceedings, Volume 2–3

These two books are the second and third volumes in a new AMS book series, Israel Mathematical Conference Proceedings, published by the Weizmann Science Press of Israel. They contain the proceedings of a workshop on L-functions, Number Theory, and Harmonic Analysis, held at Tel Aviv University in May, 1989. The workshop was organized to honor and review the impact of the work of Ilya I. Piatetski-Shapiro on the occasion of his sixtieth birthday.

Piatetski-Shapiro has been making major contributions to applied and theoretical mathematics for the past forty years. His work has touched such scientific areas as cell biology, geophysics, automata, homogeneous networks, and digital computers. These two volumes reflect the impact of his work on pure mathematics in areas ranging from trigonometrical series and analytic number theory to group representations, algebraic geometry, and automorphic L-functions.

Some of the papers in this volume were originally presented during the workshop, while others were solicited shortly afterward. All were prepared specially for this collection and are dedicated to Piatetski-Shapiro. The first volume contains papers on representation theory, while the socond focuses on analysis, number theory, and automorphic L-functions. The two volumes comprise contributions by some of the top international experts in these areas.

1980 *Mathematics Subject Classification*: 11, 22

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Season's Readings...

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Nino Boccara

Based on a third-year course for French students of physics, this book is a graduate text in functional analysis emphasizing applications to physics.

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Walter G. Kelley and Allan C. Peterson

This book is intended for junior, senior or beginning graduate courses. It is written as a modern introduction to the subject, with an emphasis on computations and applications rather than theory.

February 1991, c. 368 pp., $34.50 (tentative)
ISBN: 0-12-403325-3

C*-Algebras and Operator Theory

Gerard J. Murphy

This book constitutes a first- or second-year graduate course in operator theory. It assumes a basic knowledge in functional analysis but no prior acquaintance with operator theory is required.

August 1990, 296 pp., $44.50
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Louis Rowen

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Lars Eldén and Linde Wittmeyer-Koch

In addition to exceptional coverage of the normal range of topics in an introductory course, this book includes topics that have become particularly interesting in recent years.

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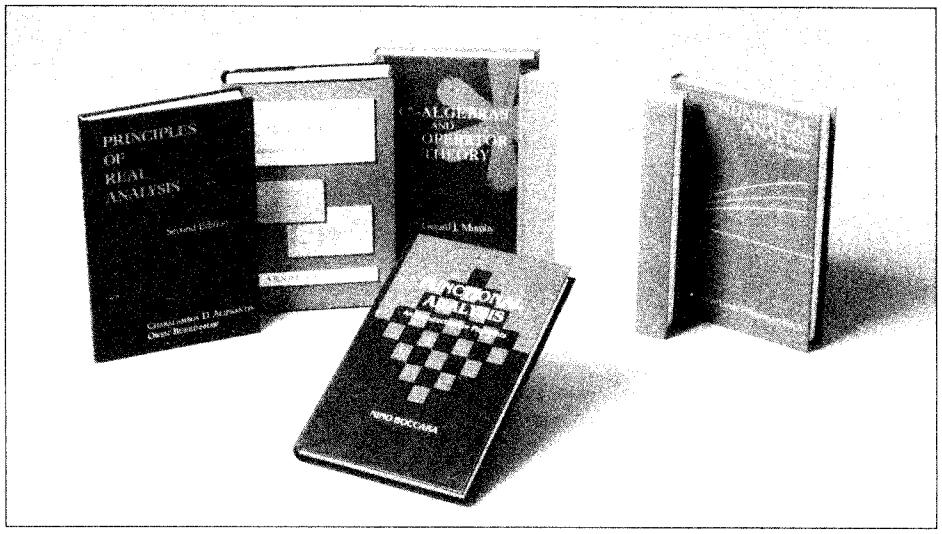

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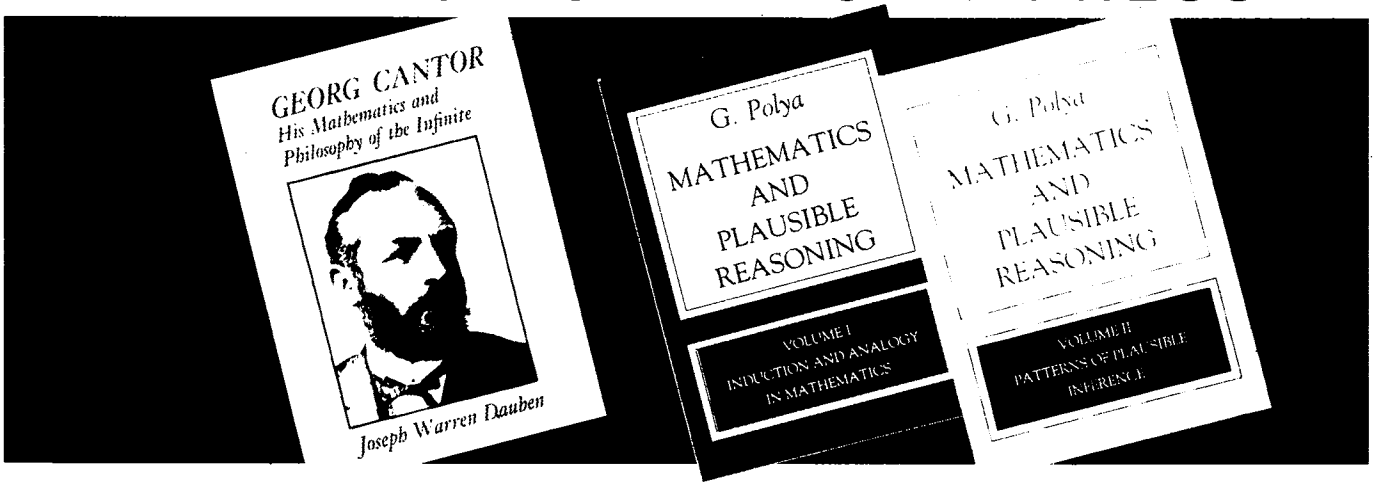

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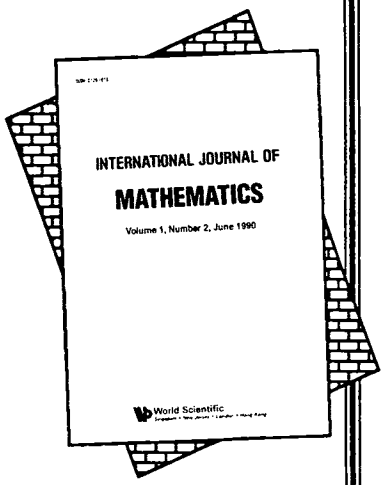

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The Institute prefers scientists who are not more than five years beyond the doctoral degree. Candidates are eligible for academic year appointments with possible extension to a second academic year. The salary is $33,000 for nine months, plus benefits. The deadline for '91-'92 applications is January 4, 1991, and awards will be made by February 15, 1991. In addition to a curriculum vitae, three (3) letters of recommendation are required, one of which should come from the thesis advisor. Reprints of published articles are appreciated. The candidate should specify a mathematical scientist at Cornell with whom (s)he expects to be associated. Candidates must be U.S. citizens. All appointments are contingent on award of Army Research Office contracts in the listed research areas.

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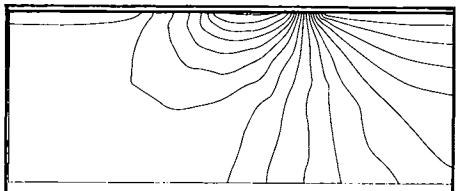

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Randolph E. Bank, Editor
(Lectures in Applied Mathematics, Volume 25)

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Degrees, with institutions and dates .....

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If you wish to be on the mailing lists to receive information about publications in fields of mathematics in which you have an interest, please consult the list of major headings of the 1980 Mathematics Subject Classification below. Select no more than five category numbers and fill in the numbers where indicated on the left. These categories will be added to your computer record so that you will be informed of new publications or special sales in the fields you have indicated.

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

Membership Categories

Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

*For **ordinary members** whose annual professional income is below $45,000, the dues are $75, for those whose annual professional income is $45,000 or more, the dues are $100.*

*The **CMS Cooperative Rate** applies to ordinary members of the AMS who are also members of the Canadian Mathematical Society and reside outside of the U.S. For members whose annual professional income is $45,000 or less, the dues are $64 and for those whose annual professional income is above $45,000, the dues are $85.*

*For a **joint family membership,** one pays ordinary dues, based on his or her income, and the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the* Notices *and the* Bulletin *as a privilege of membership, but both members will be accorded all other privileges of membership.)*

*Minimum dues for **contributing members** are $150.*

*For either **students** or **unemployed individuals,** dues are $25, and annual verification is required.*

*The annual dues for **reciprocity members** who reside outside the U.S. and Canada are $50. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement, and annual verification is required. Reciprocity members who reside in the U.S. or Canada must pay ordinary member dues ($75 or $100).*

*The annual dues for **external members,** those who reside in developing countries which do not have any mathematical society, are $53.*

*Members can purchase a **multi-year membership** by prepaying their current dues rate for either two, three, four or five years. This option is not available to either unemployed or student members.*

1991 Dues Schedule (January through December)

For any category of membership where more than one dues level is given, see the above for descriptions of Members' Categories.

Ordinary member ..... ☐ $75 ☐ $100

CMS Cooperative rate ..... ☐ $64 ☐ $85

Joint family member (full rate) ..... ☐ $75 ☐ $100

Joint family member (reduced rate) ..... ☐ $55 ☐ $80

Contributing member (minimum $150) ..... ☐

Student member (please verify)[1] ..... ☐ $25

Unemployed member (please verify)[2] ..... ☐ $25

Reciprocity member (please verify)[3] ..... ☐ $50 ☐ $75 ☐ $100

External member ..... ☐ $53

Multi-year membership ..... $ ..... for ..... years

1 Student Verification (sign below)

I am a full-time student at .....

..... currently working toward a degree.

2 Unemployed Verification (sign below) *I am currently unemployed and actively seeking employment. My unemployment status is not a result of voluntary resignation or of retirement from my last position.*

3 Reciprocity Membership Verification (sign below) *I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.*

Reciprocating Societies

- ☐ Allahabad Mathematical Society
- ☐ Asociación Matemática Española
- ☐ Australian Mathematical Society
- ☐ Berliner Mathematische Gessellschaft e.V.
- ☐ Calcutta Mathematical Society
- ☐ Dansk Matematisk Forening
- ☐ Deutsche Mathematiker-Vereinigung e.V.
- ☐ Edinburgh Mathematical Society
- ☐ Gesellschaft für Angewandte Mathematik und Mechanik
- ☐ Glasgow Mathematical Association
- ☐ Indian Mathematical Society
- ☐ Iranian Mathematical Society
- ☐ Irish Mathematical Society
- ☐ Íslenzka Staerðfraeðafélagið
- ☐ Israel Mathematical Union
- ☐ János Bolyai Mathematical Society
- ☐ Korean Mathematical Society
- ☐ London Mathematical Society
- ☐ Malaysian Mathematical Society
- ☐ Mathematical Society of Japan
- ☐ Mathematical Society of the Philippines
- ☐ Mathematical Society of the Republic of China
- ☐ New Zealand Mathematical Society
- ☐ Nigerian Mathematical Society
- ☐ Norsk Matematisk Forening
- ☐ Österreichische Mathematische Gesellschaft
- ☐ Polskie Towarzystwo Matematyczne
- ☐ Punjab Mathematical Society
- ☐ Ramanujan Mathematical Society
- ☐ Real Sociedad Matemática Española
- ☐ Sociedad Colombiana de Matemática
- ☐ Sociedad de Matemática de Chile
- ☐ Sociedad Matemática de la Republica Dominicana
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- ☐ Société de Mathématiques Appliquées et Industrielles
- ☐ Société Mathématique de Belgique
- ☐ Société Mathématique de France
- ☐ Société Mathématique Suisse
- ☐ Southeast Asian Mathematical Society
- ☐ Suomen Matemaattinen Yhdistys
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NOTI

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Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the *Combined Membership List*). In addition, the AMS maintains records of members' honors, awards, and information on Society service. Information of the latter kind appears regularly in *Notices*.

When changing their addresses, members are urged to cooperate by supplying the information requested below. The Society's records are of value only to the extent that they are current and accurate.

If your address has changed or will change within the next two or three months, please fill out this form, supply any other information appropriate for the AMS records, and mail to the address given below.

Name: _____ Customer code: _____

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OPERATOR THEORY/ OPERATOR ALGEBRAS AND APPLICATIONS

William B. Arveson
Ronald G. Douglas
Editors

Proceedings of Symposia in Pure Mathematics

Volume 51

American Mathematical Society

Operator theory has come of age during the last twenty years. The subject has developed in several directions using new and powerful methods that have led to the solution of basic problems previously thought to be inaccessible. In addition, operator theory has had fundamental connections with a range of other mathematical topics. For example, operator theory has made mutually enriching contacts with other areas of mathematics, such as algebraic topology and index theory, complex analysis, and probability theory. The algebraic methods employed in operator theory are diverse and touch upon a broad area of mathematics. There have been direct applications of operator theory to systems theory and statistical mechanics. And significant problems and motivations have arisen from the subject's traditional underpinnings for partial differential equations.

This two-volume set contains the proceedings of an AMS Summer Institute on Operator Theory/Operator Algebras, held in July 1988 at the University of New Hampshire. The Institute sought to summarize progress and examine the common points of view that now run through the subject. With contributions from some of the top experts in the field, this publication illuminates a broad range of current research topics in operator theory.

1980 *Mathematics Subject Classification*: 46L, 47A, 47B, 58G
ISBN 0-8218-1486-9 , LC 90-33771, ISSN 0082-0717
Part 1—640 pages, Part 2—385 pages (hardcover), July 1990
Individual member $104, List price $174,
Institutional member $139
To order, please specify PSPUM/51NA

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THE LEGACY OF
John von Neumann

James G. Glimm, John Impagliazzo, and Isadore Singer, Editors

Proceedings of Symposia in Pure Mathematics

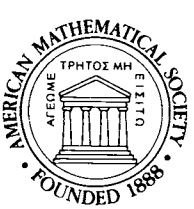
Volume

50

The ideas of John von Neumann have had a profound influence on modern mathematics and science. One of the great thinkers of our century, von Neumann initiated major branches of mathematics—from operator algebras to game theory to scientific computing—and had a fundamental impact on such areas as self-adjoint operators, ergodic theory and the foundations of quantum mechanics, and numerical analysis and the design of the modern computer.

This volume contains the proceedings of an AMS Symposium in Pure Mathematics, held at Hofstra University, in May 1988. The symposium brought together some of the foremost researchers in the wide range of areas in which von Neumann worked. These articles illustrate the sweep of von Neumann's ideas and thinking and document their influence on contemporary mathematics. In addition, some of those who knew von Neumann when he was alive have presented here personal reminiscences about him. This book is directed to those interested in operator theory, game theory, ergodic theory, and scientific computing, as well as to historians of mathematics and others having an interest in the contemporary history of the mathematical sciences. This book will give readers an appreciation for the workings of the mind of one of the mathematical giants of our time.

1980 *Mathematics Subject Classification*: 28DXX, 46LXX, 65XX, 76XX, 81XX
ISBN 0-8218-1487-7 , LC 90-33765, ISSN 0082-0717
334 pages (hardcover), July 1990
Individual member $34, List price $56,
Institutional member $45
To order, please specify PSPUM/50NA



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MAA Minicourse Preregistration Form, San Francisco, California

January 16–19, 1991

NOTE: This is NOT an AMS Short Course Form. Please use the Joint Meetings Pregistration/Housing Form to preregister for the AMS Short Course.

To register for MAA Minicourse(s), please complete THIS FORM or a PHOTOCOPY OF THIS FORM and return it with your payment to:

Linda Heineman
Mathematical Association of America
1529 Eighteenth Street, N.W.
Washington, DC 20036
Telephone: 202-387-5200

_____ Telephone: _____

(Please print) Surname First Middle

_____

Street address City State Zip

- Deadline for MAA Minicourse preregistration: November 16. 1990 (After this date, potential participants are encouraged to call the MAA headquarters at 800-331-1622.)
- Deadline for cancellation in order to receive a 50% refund: January 2, 1991
- Each participant must fill out a separate Minicourse Preregistration form.
- Enrollment is limited to two Minicourses, subject to availability.
- Please complete the following and send both form and payment to Linda Heineman at the above address:

  I would like to attend ☐ 1 Minicourse ☐ 2 Minicourses

  Please enroll me in MAA Minicourse(s): #____ and #____

  In order of preference, my alternatives are: #____ and #____

- PAYMENT

  Check enclosed: $ ____ Credit card type: ☐ MasterCard ☐ Visa

  Credit card # _____ Expiration date: _____

  _____ _____

  Your Employing Institution Signature (as it appears on credit card)

Minicourse Number and Name	Organized by	Fee
1. Calculus as a laboratory science	Marcelle Bessman	$60
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☐ I plan on preregistering for the San Francisco, California meetings **ONLY** in order to attend the MAA Minicourse(s) indicated above. It is my understanding that, should the course(s) of my choice be filled, full refund of the San Francisco meetings preregistration fee will be made.

☐ I would like to preregister for the free Student Workshop organized by the MAA Committee on Student Chapters.

NEW *NOTICES* CLASSIFIED RATES TO BEGIN JANUARY 1991

Beginning in January 1991 classified advertising rates in the *Notices* will be $55 per inch on a single column (one inch minimum), calculated from top of type; $25 for each additional 1/2 inch or fraction thereof.

Advertisements in the "Positions Available" classified section are set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Advertisements in other sections of the classified pages will be set according to the advertisement insertion.

Headlines are centered in boldface at **no extra charge**. Classified rates are calculated from the top of the type in the headline to the bottom of the type in the body copy, including lines and spaces within. Any fractional text will be charged at the next 1/2 inch rate.

Additional details may be found on the Advertising Rate Card. Any **questions should be directed to** the AMS Advertising Department, P.O. Box 6248, Providence, RI 02940; telephone 401-455-4000 or 800-321-4AMS (321-4267) in the continental U.S. and Canada; FAX 401-331-3842.

FINITE GEOMETRIES AND COMBINATORIAL DESIGNS

Earl S. Kramer
and Spyros S. Magliveras, Editors

Contemporary Mathematics, Volume 111

More than eighty participants from all over the world attended an AMS Special Session on Finite Geometries and Combinatorial Designs held in Lincoln, Nebraska in the fall of 1987. This volume contains the proceedings of that Special Session, in addition to several invited papers. Employing state-of-the-art combinatorial and geometric methods, the papers show significant advances in this area. Topics range over finite geometry, combinatorial designs, their automorphism groups, and related structures.

Requiring graduate-level background, this book is intended primarily for researchers in finite geometries and combinatorial designs. However, the interested nonspecialist will find that the book provides an excellent overview of current activity in these areas.

1980 *Mathematics Subject Classifications:* 05, 51
ISBN 0-8218-5118-7, LC 90-45302, ISSN 0065-9266
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Instructions for Applicant's Form on facing page

The form. Applicants' forms submitted for the Employment Register will be photographically reproduced in the December 1990 issue of *Employment Information in the Mathematical Sciences (EIMS).* Résumés of only those attending will be posted at the meeting.

The forms **must be** carefully **typed** using a fresh black ribbon. The best results are obtained with a carbon-coated polyethylene film ribbon, but satisfactory results may be obtained using a ribbon made of nylon or other woven fabric if suitable care is exercised. It is important that the keys be clean and make a sharp, clear impression. Do not erase—it causes smudges which reproduce when photographed. Use a correcting typewriter or correction tape or fluid if necessary. Submit the original typed version only. Copies will not reproduce properly and are not acceptable. **Hand lettered forms will be returned. Do not type outside the box.**

Applicants' forms must be received by the Society by November 16, 1990 in order to appear in the special issue of *EIMS* and must be accompanied by the Preregistration/Housing Form printed in this issue, if attending the meeting.

(A) Specialties

AL = Algebra	AN = Analysis
BI = Biomathematics	BS = Biostatistics
CB = Combinatorics	CM = Communication
CN = Control	CS = Computer Science
CT = Circuits	DE = Differential Equations
EC = Economics	ED = Mathematical Education
FA = Functional Analysis	FI = Financial Mathematics
FL = Fluid Mechanics	GE = Geometry
HM = History of Math	LO = Logic
MB = Mathematical Biology	ME = Mechanics
MO = Modelling	MP = Mathematical Physics
MS = Management Science	NA = Numerical Analysis
NT = Number Theory	OR = Operations Research
PR = Probability	SA = Systems Analysis
ST = Statistics	TO = Topology

(B) Career Objectives

AR = Academic Research	AT = Academic Teaching
NR = Nonacademic R&D	NC = Nonacad. Consulting
NS = Nonacademic Supervision	

(H) (I) Duties

T = Teaching	U = Undergraduate
G = Graduate	R = Research
C = Consulting	A = Administration
S = Supervision	IND = Industry
GOV = Government	DP = Data Processing

Location

E = East		S = South
C = Central		M = Mountain
W = West	O = Outside U.S.	I = Indifferent

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER

APPLICANT FORM JANUARY 16-18, 1991 SAN FRANCISCO, CALIFORNIA

1. **Form must be typed. (Please see instructions on facing page.)**
2. **This form CANNOT be submitted by electronic mail.**
3. **Hand lettered forms will be returned. Do not type beyond the box**
4. **Please check if Preregistration/Housing Form previously sent** ☐
5. **Return form with payment with your Preregistration/Housing Form by November 16 to AMS, P.O. Box 6887, Providence, RI 02940.**

APPLICANT: Name_____

CODE: Mailing address (include zip code) _____

_____

Ⓐ Specialties_____

Ⓑ Career objectives and accomplishments

ACADEMIC: ☐ Research, ☐ Teaching

NON-ACADEMIC: ☐ Research and Development, ☐ Consulting, ☐ Supervision

Near-term career goals_____

_____

Significant achievements or projects, including role_____

_____

Honors and offices_____

Other (e.g., paper to be presented at THIS meeting)_____

_____

Selected titles of papers, reports, books, patents_____

_____

Ⓒ Degree Year Institution

____ ____ _____ Ⓓ No. of abstracts, internal reports_____

____ ____ _____ Ⓔ No. of papers accepted_____

____ ____ _____ Ⓕ No. of books and patents_____

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	Present	Previous	Previous
Ⓖ Employer			
Position			
Ⓗ Duties			
Years	____ to ____	____ to ____	____ to ____

DESIRED POSITION:_____

Ⓘ Duties_____

Ⓙ Available mo.____ /yr.____ Location_____

Ⓚ References (Name and Institution)

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_____

_____

Ⓛ Citizenship: (check one) ☐ U.S. Citizen ☐ Non-U.S. Citizen, Permanent Resident

☐ Non-U.S. Citizen, Temporary Resident

Ⓜ AVAILABLE FOR INTERVIEWS:

(Interviews for Session 4 scheduled on the basis of employer's request only.)

Session 1 ☐	Session 2 ☐	Session 3 ☐	Session 4 ☐
Thurs. AM 9:30-11:45	**Thurs. PM 1:15-5:00**	**Fri. AM 9:30-11:45**	**Fri. PM 1:15-5:00**

I do not plan to attend the San Francisco meetings ☐

EMPLOYER FORM MATHEMATICAL SCIENCES EMPLOYMENT REGISTER SAN FRANCISCO, CALIFORNIA JANUARY 16-18, 1991

This form CANNOT be submitted by electronic mail..

INSTRUCTIONS: Please read carefully before completing form below. **Circled** letters identify corresponding items in the FORM and the SUMMARY STRIP; abbreviations to be used are provided in the notes below. Please **print** or **type** in black ink. Block capitals are suggested. The FORM itself will be placed on display at the Register exactly as submitted. The SUMMARY STRIP (be sure to complete) will be used to prepare a computer printed list of summaries for distribution at the Register sessions. Employers are encouraged to provide more than one interviewer when they are able to do so, in order to increase the number of interviews which may be scheduled. Please take care to indicate on the Form the number of interviewers for whom simultaneous interviews may be scheduled. (If all interviewers will be interviewing for the same position, or for the same set of positions, only one form should be submitted and only one employer code number will be assigned; therefore, each interviewer would then receive a separate computer schedule and separate table number.) More than one employer code will be required if some interviewers will not interview for all positions. Thus, if there are two disjoint sets of positions, two forms are required and two employer codes will be assigned. **(Please refer to the section on the Employment Register following the San Francisco meeting announcement.) Return form with payment with your preregistrtion/Housing form by Nov. 16.**

EMPLOYER CODE Institution _____ Dept. _____

Name of Interviewer(s) 1. _____ 2. _____

3. _____ 4. _____

City, State, Zip _____

(A) Title(s) of Position(s) _____ (B) Number of Positions _____ Number of People Supervised _____

(C) Starting Date ____ mo. / ____ yr. (D) Term of Appointment ____ yrs. (E) Renewal ( ) Possible ( ) Impossible Tenure Track Position Yes ( ) No ( )

Teaching hrs./wk _____ (F) Specialties Sought _____

(G) Degree Preferred _____ (H) Degree Accepted _____ (I) Duties _____ (J) Experience _____ (K) Citizenship Restriction _____

(L) **Available for Interviews**

Session 1 ( )	**Session 2 ( )**	**Session 3 ( )**	**Session 4 ( ) ***
Thurs. AM, 9:30-11:45	**Thurs. PM, 1:15-5:00**	**Fri. AM, 9:30-11:45**	**Fri. PM, 1:15-5:00**

(M) **Number of Interviewers** _____ **Interviewers** _____ **Interviewers** _____ **Interviewers** _____ **Interviewers**

Institution, City, State, (A) Title of position, (B) No., (C) Start mo. / yr.

(D) (E), (F) Specialities sought, (G) (H), (I) Duties, (J) Experience, (K), (L) Sessions

NOTES: (A) Inst, Lect, Asst Prof, Asso Prof, Prof, Dean, Open, MTS (Member Technical Staff), OPAN (Operations Analyst), PREN (Project Engineer), RESC (Research Scientist); (C) Date e.g. 01/91; (E) Possible=P, Impossible=I; (F) Algebra=AL, Analysis=AN, Biomathematics=BI, Biostatistics=BS, Combinatorics=CB, Communication=CM, Control=CN, Computer Science=CS, Circuits=CT, Differential Equations=DE, Economics=EC, Mathematical Education=ED, Functional Analysis=FA, Financial Mathematics=FI, Fluid Mechanics=FL, Geometry=GE, History of Mathematics=HM, Logic=LO, Mathematical Biology=MB, Mechanics=ME, Modeling=MO, Mathematical Physics=MP, Management Science=MS, Numerical Analysis=NA, Number Theory=NT, Operations Research=OR, Probability=PR, Systems Analysis=SA, Statistics=ST, Topology=TO; (G)(H) Bachelor=B, Master=M, Doctor=D; (I) (J) Teaching=T, Undergraduates=U, Graduates=G, Research=R, Consulting=C, Administration=A, Supervision=S, Industry=IND, Government=GOV, Data Processing=DP, no experience required=N; (K) U.S. Citizen=C, U.S. Citizen or permanent resident=CP, No restriction=NR; (L) Periods available for interviews: Check 1, 2, 3, and/or 4, see the FORM above.

* Interviews are scheduled in this session on the basis of employers request only.

Preregistration/Housing Form, San Francisco, California

January 16–19, 1991

Please complete this form and return it with your payment to
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P.O. Box 6887, Providence, Rhode Island 02940 - Telephone: (401) 455-4143-Telex: 797192

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	Housing Changes/Cancellations	December 12, 1990
	50% Refund Preregistration/Employment Register/AMS Short Course Cancellation	January 11, 1991 (no refunds after this date)
	Other Changes to Preregistration	January 2, 1991
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		REGISTRATION FEES Preregistration by December 17, 1990	At Meeting
		$	$
JOINT MATHEMATICS MEETINGS			
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	Nonmember	163	212
*	Student, Unemployed, or Emeritus	25	33
AMS SHORT COURSE			
	Member/Nonmember	55	70
*	Student, Unemployed, or Emeritus	25	30
EMPLOYMENT REGISTER	- Employer fee (1st Interviewer)	120	160
	- Employer fee (2nd / 3rd Interviewer)	60	75
	- Applicant fee	25	40
	- Posting fee for job descriptions for noninterviewing employers	25	25

(N.B.: A separate form appears in this issue for preregistration for MAA Minicourses)

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PREREGISTRATION SECTION: Please check the function(s) for which you are preregistering:

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1) _____ Telephone: _____
(Please print) Surname First Middle

2) _____
(Mailing address)
I do not wish my badge, program, and/or Employment Register material to be mailed; however, the mailing address for my acknowledgement is given above. ☐

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4) I am a student at _____ 5) Emeritus member ☐ Unemployed ☐ MR Classification # _____

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7) Joint Meetings fee $ _____ 8) **AMS** Short Course fee $ _____ 9) Employer fee(s) $ _____ 10) Co-Interviewer fee(s) $ _____

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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)

Please complete the appropriate sections on the reverse.

For office use only:

Codes:	Options:	Hotel:	Room type:
Dates:	Hotel Deposit	Total Amt. Paid:	
Special Remarks:			

HOUSING SECTION: PREREGISTRATION/HOUSING FORM, San Francisco, California January 16–19, 1991

☐ PLEASE CHECK HERE IF YOU WILL **NOT** REQUIRE A ROOM ☐ PLEASE CHECK HERE IF YOU WILL BE STAYING AT A HOTEL/MOTEL **NOT** LISTED BELOW

EVEN IF HOUSING IS NOT NEEDED, PLEASE GIVE ARRIVAL/DEPARTURE DATES BELOW.

Please rank hotels in order of preference by writing 1, 2, 3, etc. in the spaces at the left on form, and by circling the requested room type and rate. If the rate requested is no longer available, you will be assigned a room at another hotel at the next available rate. **If not all hotels are ranked, and all rooms have been filled at the ranked hotels, the assignment will be made at an unranked hotel with the next available rate.** Rates listed below are subject to 11% sales/occupancy tax.

The hotels listed below are full service hotels. The Hilton, Handlery, and Raphael offer a **LIMITED** number of nonsmoking rooms. All of the rooms in the King George have windows that open. The Mark Twain does not have nonsmoking rooms. The hotels listed below are equipped for handicapped; however, the King George is not equipped for the handicapped with wheelchairs. Special attention will be given to participants with special needs. Please note that the King George and the Raphael offer a limited number of twin beds.

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Order of choice		Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites* (starting rates)
	Hilton (Headquarters Hotel)	**(See Hilton categories below.)**							
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	Superior	95	107	107	127	N/A	147	N/A	192 +
	Standard - Regular	82	95	95	115	N/A	135	N/A	192 +
	Standard - Student or Unempl.**	65	65	65	65	N/A	65	N/A	192 +
	Handlery Hotel	75	75	75	85	N/A	95	N/A	125 +
	King George Hotel	71	75	N/A	N/A	N/A	N/A	N/A	178
	Hotel Mark Twain	70	70	70	N/A	85	N/A	N/A	165
	The Raphael	69	69	N/A	N/A	N/A	N/A	N/A	110 +

*** 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 on the opposite side of this form) to qualify for these rates.**

Special housing requests, handicapped needs, etc.: _____

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 ages of children.

FULL NAME ARRIVAL DATE DEPARTURE DATE

_____

_____

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