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Calendar of AMS Meetings and Conferences

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

Abstracts of papers presented at a meeting of the Society are published in the journal *Abstracts of papers presented to the American Mathematical Society* in the issue corresponding to that of the *Notices* which contains the program of the meeting, insofar as is possible. Instructions for submission of abstracts can be found in the January 1993 issue of the *Notices* on page 46. Abstracts of papers to be presented at the meeting must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline given below for the meeting. Note that the deadline for abstracts for consideration for presentation at special sessions is usually three weeks earlier than that specified below.

Meetings

Meeting #		Date	Place	Abstract Deadline	Program Issue
893	†	June 16–18, 1994	Eugene, Oregon	Expired	May-June
894	*	August 15–17, 1994 (96th Summer Meeting)	Minneapolis, Minnesota	May 17	July-August
895	*	October 28–29, 1994	Stillwater, Oklahoma	August 3	October
896	*	November 11–13, 1994	Richmond, Virginia	August 3	October
897		January 4–7, 1995 (101st Annual Meeting)	San Francisco, California	October 3	December
898		March 4–5, 1995	Hartford, Connecticut		
899		March 17–18, 1995	Orlando, Florida		
900		March 24–25, 1995	Chicago, Illinois		
		August 6–8, 1995 (97th Summer Meeting)	Burlington, Vermont		
		October 7–8, 1995	Boston, Massachusetts		
		November 3–4, 1995	Kent, Ohio		
		November 17–18, 1995	Greensboro, North Carolina		
		January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		
		March 22–23, 1996	Iowa City, Iowa		
		April 13-14, 1996	New York, New York		
		April 19–21, 1996	Baton Rouge, Louisiana		
		May 24–26, 1996	Jerusalem, Israel		
		November 1–3, 1996	Columbia, Missouri		
		January 8–11, 1997 (103rd Annual Meeting)	San Diego, California		
		January 7–10, 1998 (104th Annual Meeting)	Baltimore, Maryland		

* Please refer to page 495 for listing of special sessions.
† Please refer to the Table of Contents for further information.

Conferences

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

Other Events Cosponsored by the Society

October 8–14, 1994: Symposium on the Legacy of Norbert Wiener: A Centennial Symposium, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Deadlines

	September Issue	October Issue	November Issue	December Issue
Classified Ads*	July 25, 1994	August 29, 1994	October 3, 1994	November 7, 1994
News Items	July 13, 1994	August 24, 1994	September 21, 1994	October 25, 1994
Meeting Announcements**	July 13, 1994	August 24, 1994	September 21, 1994	October 25, 1994

* Please contact AMS Advertising Department for an Advertising Rate Card for display advertising deadlines.
** For material to appear in the Mathematical Sciences Meetings and Conferences section.

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From the Executive Director . . .

DEFINING MATHEMATICAL SCHOLARSHIP

Note: How to define scholarship is a matter of intense debate in the academic community today. The following text, taken from the appendix to the report "Professional Recognition and Rewards in the Mathematical Sciences", provides a starting point for mathematical science departments trying to formulate a definition of scholarship. An article in this issue of the *Notices* provides further information about the report.

College and university faculty members are scholars as well as teachers. They must stay abreast of the latest developments in their fields in order to remain effective as teachers. Academic scholars provide an important resource that can be drawn upon to address pressing local, regional, and national needs.

But what is scholarship? For some, scholarship is defined narrowly as research leading to new knowledge that is publishable in the leading research journals. Others define scholarship broadly as any activity that leads to increased knowledge or understanding on the part of the individual scholar. Between these two extremes is a variety of activities that may or may not be recognized as scholarly by those who make judgements about scholarship.

Each mathematical sciences department should formulate an explicit and public definition of scholarship. This definition should, of course, be consistent with the mission of the institution. It should embrace the variety of scholarly activities in all fields that the institution and the department wish to encourage and support.

Following is a draft definition of scholarship for the mathematical sciences that may serve as a guide to departments seeking to formulate their own definitions. This draft will, of course, need to be modified by each department to reflect its own values and mission and to conform to the institutional mission.

Scholarship in the mathematical sciences includes:

- research in core or applied areas that leads to new concepts, insights, discoveries, structures, theorems, or conjectures;
- research that leads to the development of new mathematical techniques, or new applications of known techniques, for addressing problems in other fields including the sciences, the social sciences, medicine, and engineering;
- research in teaching and learning that leads to new insights into how mathematical knowledge and skills are most effectively taught and learned at all levels;
- synthesis, or integration, of existing scholarship, such as surveys, book reviews, and lists of open problems;
- exposition that communicates mathematics to new audiences, or to established audiences with improved clarity, either orally or in writing, including technical communications to scientists, engineers, and other mathematicians, as well as books, articles, multimedia materials, and presentations for teachers, government leaders, and the general public;
- development of courses, curricula, or instructional materials for teaching mathematics in K–12 as well as at the college level; and
- development of software that provides new or improved tools for supporting research in mathematics or its applications, for communicating mathematics, or for teaching and learning mathematics.

Good scholarship, in whatever form it takes, must be shared in order to have value. It must benefit more than just the scholar. The results of scholarly activities must be public and must be amenable to evaluation. Techniques appropriate for the evaluation of scholarship in the mathematical sciences include peer review and invitations to present results to others; awards and other forms of recognition; and impact measures, such as citations, evidence of the use of the scholarship in the work of others, evidence of improved effectiveness of a technique or activity as a result of the scholarly contribution, or evidence of improved understanding of mathematics on the part of some consumer group as a result of the scholarly activity.

William Jaco

Letters to the Editor

Changes Facing the Mathematics Community

The December *Notices* reinforced in me an impression that has been growing for some time: The mathematical community does not appreciate the scope and importance of the changes sweeping American organizations. As the change wave hits the NSF, the community remains in a state of denial. We act as if it were all a fad, as if we need only add the new buzzwords to our vocabularies and do another creative rewriting of our grant proposals. Saunders MacLane undoubtedly speaks for many when he contemptuously writes, "Strategic research is the latest slogan" and argues that fundamental change in the outlook of the AMS is unnecessary.

There has indeed been a lot of hype in the media about "competitiveness" and "quality" and "reengineering". But behind all the buzzwords is a very simple notion that is revolutionizing American society: organizations should be rationally designed. Each piece should contribute to the mission of the whole, not accidentally or incidentally, but in its essence. Central to the implementation of this idea is the breaking up of internal franchises or bottlenecks that allow elite groups within the organization to divert organizational resources to pursue their own goals. Company after company has been through this restructuring process and has shed thousands of jobs without noticeably affecting its ability to perform its mission. Now the same ideas are being applied to government. Naturally, government has a great deal of inertia, and it will take a long time for these ideas to take hold. But the trend will be with us for a long time, and the sooner we all adjust to it the better.

What this means is that arguing for the general goodness of mathematics is not going to have any long-term effect on the allocation of federal funds. Anecdotes about the unreasonable effectiveness of boolean algebra or Radon transforms are not going to be relevant to the debate that will go on (and already is going on). The U.S. government has a mission to perform on behalf of the voters and taxpayers it represents. How will our program help it perform that mission? Is there any hard evidence to support the claim that countries that support mathematics have an advantage over countries that don't? If the NSF (and its Division of Mathematical Sciences) can't answer questions like these, it will lose its claim on public funding. This was the import of the Senate subcommittee's warning (quoted in the "Washington Outlook" column) that the NSF could "diminish into nothing more than a national endowment for science."

Answering these questions will not be just a matter of better public relations or better marketing of the same proposals, because the bulk of American mathematics is *not* helping the U.S. government perform its mission. The research community is global, and it simply does not matter what country basic research comes from. (When we use a Fourier transform, we do not care that Fourier was French.) Federal support will eventually go almost entirely to applicable mathematics and to mathematicians working with interdisciplinary teams of researchers on problems that *will* give the American economy an advantage. Depending on your tastes, you might argue that this will lead to bad mathematics. But this is our problem, *not the government's*.

It is only a matter of time before the same forces reorganize the university, and mathematics stands to suffer there as well. A mathematics department makes most of its money by teaching remedial service courses, as Gail Young's letter demonstrates very effectively. For the most part it provides this service reluctantly and badly and diverts the income to support its own major goal, research. It gets away with doing this because it has the mathematics franchise within its university and is free from competition. When the rational-design wave hits the universities, this franchise will end (perhaps in the way that Young envisions, with the establishment of a Department of Precalculus Mathematics), and mathematics departments will either have to reorganize themselves to take remedial teaching seriously (hiring and firing as appropriate) or give up the bulk of their income (and fire without hiring).

In short, the restructuring wave that is sweeping our society is not a fad, and it will not stop before it reaches us. The mathematical community will have to change completely over the next fifteen years or so, and we should be preparing ourselves, our students, and our departments for the shocks that are sure to come. The day when we could pursue our fancy and rationalize that someone will eventually find a use for it is fast ending. It is time that we took a good look at ourselves and our subject and asked whether there is some needed service that we can perform. Otherwise, most of us are going to be out on the street.

Douglas Muder
Mitre Corp.
(Received December 27, 1993)

Responses to John Saxon

I am thrilled that the AMS has entered the debate on mathematics education, as evidenced by several recent letters and articles in the *Notices*. In the February issue was a strongly worded attack by John Saxon, a public school mathematics textbook author and publisher, on the ideas embodied in the *Curriculum and Evaluation Standards for School Mathematics* published by the National

Letters to the Editor

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

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

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

The committee reserves the right to edit letters.

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

Council of Teachers of Mathematics in 1989. Give me a few paragraphs to disagree as forcefully as I can.

Mr. Saxon correctly observes that the current state of K–12 mathematics education is abysmal. What he fails to recognize is that the current population of poorly prepared students is the result of the current system. We *know* that the current system does not work, so his suggestions—of continuing to teach paper-and-pencil computations, toy word problems, algebraic manipulation as the primary skill to be acquired, and calculus for a third of all seniors—have to be *more* contradictory than trying a new system that, while perhaps not yet fully tested, at least makes sense. And it makes sense not just to the mathematics educator "experts" who crafted it; a lot of it (but certainly not all!) makes sense to many of us out in the real world of higher education.

I've been teaching mathematics, statistics, and computer science at all levels in a state university with slightly above-average college students. I've seen the lack of preparation caused by a high school curriculum that avoids getting into depth; never bothers to teach students how to use their calculators effectively; breaks mathematics down into one-step algorithms devoid of understanding; requires no writing; and doesn't teach them much of anything about discrete mathematics, logic, problem solving, probability, and statistics in order to let large numbers of them take calculus in their senior year with no intention of placing out of college calculus via the AP exam. It's the current system that focuses on symbol pushing instead of understanding that let one of my students do a computation on a test last week and conclude, thinking she had the right answer, that a proposed sales tax increase would amount to $200,000 per year per capita.

For the past few semesters I've been teaching the mathematics content course for elementary education majors. I use one of the harder textbooks designed for this subject and teach them real, hard (for them) content, including, for example, understanding the proof that $\sqrt{2}$ is irrational and a mental perpetual calendar algorithm. But I also have them read the K–8 sections of the *Standards* and preach the sensible parts of its gospel throughout the course—that doing mathematics involves effective communication; that you need to learn to apply problem-solving strategies to problems that aren't from the same template as the ones you've been shown how to do; that once you get an answer to a problem you need to see whether it makes sense; and that mathematics is much more a matter of modeling and solving real world problems, reasoning logically, finding patterns, and appreciating the profound truths than it is calculating, factoring polynomials, or plugging into the right formula. Many of my students are amazed, panicked, angry, and hostile at the beginning, clinging to what they've learned to understand (and often hate) as mathematics their whole lives. By the end, I've won most of them over, and they are going to be the really effective teachers for the next generation; I hope that the low grades I give to those that still don't "get it" will prevent them ultimately from landing a position in which they could pass on their own poor practices and attitudes.

So, obviously, there are strong opinions on both sides here. Thank you for sponsoring the dialog among us "real mathematicians" (who love, care about, and do both research *and* teaching), for it will affect us profoundly in the years to come.

Jerrold W. Grossman
Oakland University
(Received February 8, 1994)

I am pleased to see issues of K–12 education being discussed in the *AMS Notices*. It is long past the time when the AMS and its members should have become involved in K–12 education.

Let me disagree, however, with much of what John Saxon wrote in the February *Notices*. Granted, the NCTM *Standards* are not perfect. Documents produced by national committees seldom are. And granted, there are many pedagogical issues that need to be carefully looked at—the use of calculators springs to mind. But many mathematicians feel that the *Standards* are pointing in the right direction—towards the ability to solve complex problems and towards mathematical understanding.

The best way to see what the *Standards* make possible is to look at some of the better curriculum material that has been produced to "meet the *Standards*". I will name only two of these: the University of Chicago School Mathematics Project (for middle school and secondary) and Heath's elementary series. Both of these have in common an increase in sophistication, seriousness, and thoughtfulness over previous textbooks. Neither of them throw out algorithms or are designed to produce mathematically illiterate students. And it is precisely the language of the *Standards* that makes these books appealing to school districts.

The comparison between a text series like Heath's and Saxon's series is quite illuminating. While Saxon has his good points, the main message his books give is that you learn mathematics by learning specific algorithms for specific and highly stylized situations, and you do mathematics by applying these algorithms to these specific and highly stylized situations. This is not what mathematicians do, it is not how mathematics is used, and it is not what we should be teaching our children.

Have the *Standards* been used to justify bad mathematics teaching? Of course. Bad teachers will use whatever official jargon exists to justify what they are doing. This is yet another reason why mathematicians need to become involved in K–12 mathematics.

Judith Roitman
The University of Kansas
(Received February 17, 1994)

Shame on the Editors of the *Notices* for publishing John Saxon's self-serving diatribe (Forum, Feb. 1994) as if it were a serious contribution to the ongoing mathematics education debate! And what are we, your readers, to make of the "Editor's Note" that Saxon's mathematics series "has been used in over 4,000 American schools"? Is it intended to confer some sort of expert status on John Saxon? Or does it merely say that 4,000 American schools are so desperate for change that they will try *anything*—even the Saxon books?

As is so often the case with demagoguery, Saxon started by disingenuously setting up a straw man, a profoundly fallacious misstatement of the NCTM's "recent actions". This allowed him to pursue his agenda of denigrating virtually everyone but John Saxon, thereby promoting his own materials at the expense of accuracy, veracity, and constructive discussion. Could you not see this transparent ploy? It is a well-known principle of elementary logic that false axioms permit one to prove even the most arrant nonsense; why did you waste our valuable reading time by printing this three-page example?

There are so many logical inconsistencies and cheap rhetorical tricks in this article that the very length of any detailed response would accord it far more dignity than it deserves. However, let there be no doubt about the existence of such gamesmanship in this silly piece; here is one typical example. Saxon says:

> "Calculators and computers for classroom use had been recommended since 1972. Neither of these instruments had been shown to be effective at that time, but a drowning man will grasp at any straw. The NCTM felt that leadership was necessary, so they threw together a document . . ."

These few lines typify Saxon's questionable logic and unquestionable mudslinging. What does it mean to say that calculators and computers had not been "shown to be effective at that time"? Effective for what—for calculating and computing or (presumably) for educating students in mathematics? If the latter, how could one expect a proof of effectiveness *at that time*? Surely, one would need time to assess the effects, not only of the recommendation but of the various implementations of that recommendation? Is Saxon claiming that there is no evidence *now* to support the wisdom of that recommendation *then*, or that there was no evidence *then* to support the wisdom of that recommendation *then*, or . . . ? No matter. The reader is not expected to consider this point seriously, anyway, because the NCTM is to be perceived as "a drowning man" that desperately and irresponsibly "throws together" a document to save itself. Setting aside the legitimate question of whether or not one agrees with the NCTM's document, is Saxon's cynical portrayal of the circumstances of its creation even remotely accurate? Was the NCTM trying to save itself? Hardly. Did the drafters of the document and those who approved it work in such haste that they did not carefully consider, weigh, and debate the implications of their words? I think not. Nevertheless, Saxon appears to believe that the mere fact that their recommendations conflict with his predilections gives him license to denigrate their efforts by innuendo.

If John Saxon is really so desperate to promote his books, he should be required to buy advertising space. Then he could say whatever he pleased, unfettered by common sense, elementary logic, or good manners.

William P. Berlinghoff
Farmington, ME
(Received February 25, 1994)

Cultural Aspects of Mathematics Education Reform

I find it hard to believe that mathematics education can be hindered by mistaken cultural assumptions of the simple sort adduced by Michael Fellows and Ann and Neal Koblitz in their paper "Cultural aspects of mathematics education reform" (these *Notices*, vol 41, Jan. 1994). I suggest that their list of examples of things we must avoid is just another entry in the ethnic and gender guilt sweepstakes that is infecting the universities these days.

"We can easily let our own background and biases affect the problems selected," they write. "As a result, children with different backgrounds have difficulty comprehending and relating to the unfamiliar material. Sometimes people who have the best intentions are guilty of this."

1. "The Good Guys have a three-game lead . . . for the pennant . . . " is the way one California mathematics exam begins, and our authors warn, ". . . clearly boys are more likely than girls to be inspired by this example."

2. Concerning a problem whose setting is the western migration (in this country) of the mid-nineteenth century, they comment, "The perspective is that of the white colonists. Would Native American and Chicano children, many of whose ancestors were displaced or killed in the conquest of North America, identify with this point of view?"

3. When the authors presented a graph problem to children in Peru and phrased it as a minimization of the number of ice cream stands needed to serve the people of "Tourist Town" adequately, they found the children puzzled, because Peruvian ice cream is sold in such a way that the minimization asked for would be pointless in their experience or perhaps undesirable.

Now, of course, a problem cannot get across to children if it is downright meaningless in their culture, but I think the authors were missing a good cross-cultural bet in some of these cases. It might interest Peruvian children to know how ice cream is sold in the United States and to know that (as the authors explain) we suffer from a shortage of vendors compared to the superabundance of Peru. I think it should take only a few minutes to get this across.

In the case of the Oregon Trail, there is no question of mathematical confusion. The problem itself (to calculate the rate of depletion of supplies, etc.) is comprehensible even to those who have been taught to regard that migration as evil. But goodness, here is a chance to teach a bit of history on the side: The migration did, after all, take place and was a defining experience for many Americans. Should we suppress this story?

And baseball. Shall the presence of females in a math class render certain things unmentionable? Are they only interested in dolls?

The notion that one "cannot relate to" things outside one's culture is simply false. When I was ten years old, I had a fair understanding of "Robin Hood" and "The Ugly Duckling", though I lived in rooms behind my father's dry goods store in Detroit and had never seen a forest, bow, arrow, duck, or swan. Had my teachers been more sensitive, I might have grown up believing the whole world looked like Detroit on the Baker streetcar line.

Every "story problem" used as an

illustration in school mathematics implies a point of view and a cultural setting. It is the very opposite of what should be called "multiculturalism" to suppress such bias, keeping strictly to the assumptions and experience already held by our young audience for fear they will not "relate to" anything else. Fortunately, it is not possible to neutralize all the examples even if we try.

Ralph A. Raimi
University of Rochester
(Received February 1, 1994)

We commend the publication of the provocative article "Cultural Aspects of Mathematics Education Reform", which appeared in the January 1994 *Notices*. The article discusses several key issues in mathematics education reform, and we wholeheartedly endorse its premise that curriculum development should include considerations of cultural relevance to the reader/student.

In response to the article's reference to the Interactive Mathematics Program (IMP) curriculum as an example of unintentional cultural bias, we note first that the article's discussion of IMP was apparently based on early descriptive material that is now outdated. The citations of curriculum content are drawn from a 5-page summary of what is currently a 1,700-page core curriculum.

Before we comment on the article's specifics, here are a few facts about the program overall:

1. IMP is a four-year college preparatory, problem-based mathematics curriculum for high school students. One of IMP's goals is to make the learning of a core mathematics curriculum more accessible, especially to those groups who traditionally have been under-represented in college mathematics classes, such as women and minorities.

2. IMP began as part of a curriculum development effort funded by the California Postsecondary Education Commission (CPEC).

Today, with additional five- year funding from the National Science Foundation, IMP has embarked on a nationwide dissemination program. As part of the NSF grant, the original curriculum is undergoing a major revision process, with input from mathematicians, classroom teachers, students, and parents—a group containing a diversity of ethnic and socioeconomic backgrounds.

3. When we began writing and testing the curriculum, we carefully selected pilot schools that represented a broad range of student backgrounds and have insisted on working with heterogeneous classes that cut across racial, economic, and other "tracking" lines within schools. We have maintained these criteria as the program expanded from its three initial schools to a current implementation in almost sixty schools in eleven states in the U.S.

The *Notices* article refers specifically to four units from the IMP curriculum. One of these units, *The Dawning of the Age of Aquarius*, no longer exists as such within the curriculum. Another unit, *The Overland Trail*, has already undergone major revision for precisely the reasons suggested in the article. While retaining the setting of the migration across North America in the mid-eighteenth century, the new version incorporates other perspectives on the period, especially that of Native Americans. These changes will be field-tested with a wide range of students before the curriculum is published for general use.

Regarding the article's assertion that the IMP unit *Pennant Fever* appeals more to boys than to girls, our experience in the classroom has been that *Pennant Fever* works quite well with both girls and boys. There are other problems within this unit and in other units that probably appeal more to girls than to boys. But, equally important, as the article's authors acknowledge, almost any situation will appeal more to some students than to others. Does this mean that we should only teach mathematics (or other subjects) outside of any real situation? Rather, we have sought a balance of contexts. (More on this point later.)

Finally, the article states that the unit *Leave Room for Me*! "suggests a certain political judgment that is popular in the U.S. and Europe: that population growth must somehow be decreased among the fastest growing segments of the world's people and that otherwise these people will overrun us." Perhaps the early description of the unit in our information packet was awkwardly phrased, but there is no endorsement of the aforementioned point of view in the unit, implicit or explicit. The unit as a whole presents a balanced perspective on the issue of population control, and one of the early assignments asks students to research some social aspect of population growth. As for the mathematics of population growth, the unit recognizes that population growth does not follow a simple exponential pattern. As students work with the data and the mathematics, they learn that mathematical models don't always work well in addressing complex socioeconomic issues.

In summary, our approach to the issue of cultural relevance has been to seek a balance of material that broadens the scope of problem-solving contexts. It is certainly not our contention that the IMP curriculum is totally devoid of cultural bias. But we have obtained feedback on the material from a wide range of people. We are confident that our efforts to avoid problem contexts that offend the reader/student have been thorough and that our commitment to diversity is sustained throughout the units in the form of interesting content that may happen to engage one group more than another.

We would caution that, in the endeavor to serve the principle of cultural relevance, there may be a danger among curriculum developers of avoiding any interesting content for fear of becoming offensive or controversial to one or more cultural groups. This could result in some pretty bland material, which would assuredly turn students off rather than motivate them to study mathematics seriously.

IMP represents an attempt to realize the NCTM standards and to encourage more students from different backgrounds to pursue four years of high school mathematics. Current data show that IMP students, especially girls and minorities, are taking more mathematics than students in traditional math programs. We don't claim to have all the answers, but we are moving in a promising direction.

Thank you for this opportunity to explain IMP further to *Notices* readers.

Dan Fendel and Diane Resek
San Francisco State University
Lynne Alper and Sherry Fraser
Lawrence Hall of Science
(Received February 17, 1994)

Response from Koblitz, Koblitz and Fellows

As we said in our article, our remarks on inadvertent cultural bias in the four units in no way should be taken as a criticism of the overall work of the Interactive Mathematics Program (IMP). On occasion during our travels, we ourselves have unintentionally used culturally inappropriate material (e.g., the ice cream stand problem in Peru). This trap is easy to fall into, even if one tries to be careful.

We are glad that the IMP directors apparently agree with our criticisms of two of the units we mentioned (*The Dawning of the Age of Aquarius* and *The Overland Trail*). Concerning *Pennant Fever*, the bias there is undoubtedly the least of the four units, so we don't want to harp on that one. Suffice it to say that the term "pennant" refers to professional baseball, which is all-male. Many other professional sports titles include large numbers of women as well as men both among competitors and fans—and so our preference would have been to choose one of those sports and make the topic gender-neutral. However, we do not regard that as a major issue.

Our disagreement with the IMP directors regarding *Leave Room for Me!* is more serious. Perhaps it would help to explain our point of view more thoroughly than we had space for in our article.

In the most recent version of *Leave Room for Me!* (which Dr. Fendel kindly sent us), we were disappointed to note that (1) it still has the same paranoic title; and (2) a guide for the teacher on day 1, titled "The More the Merrier?", is clearly designed to lead the teacher and children to the conclusion that the more is *not* the merrier and that population growth *causes* problems of hunger, pollution, and traffic. The choice of simplistically blaming those problems on population growth is a highly *political* choice.

To illustrate our objection, consider replacing the current unit with one entitled *Is There Any Left for Me?* that uses the well-known statistics on the vast differences between resources consumed per capita in the First and Third Worlds. The lesson could have essentially the same mathematical content, with discussion of an exponential model for increase in consumption in the wealthy countries. The point of view of the unit would be that of an impoverished child in a developing country. In our opinion, such a lesson would convey a more cogent message. Our point, however, is *not* to urge the IMP directors to change to a lesson that accords with our own point of view. Rather, we urge them simply to avoid *any* heavy-handed sociopolitical message dressed up as mathematics.

The political opinion supported by the *Leave Room for Me!* unit—that population growth is the main cause of hunger, environmental degradation, and traffic congestion—is far from the only possible opinion one could have. For example, one might believe (1) that these evils are caused by the economic inequity inherent in Western capitalism, or (2) that these evils are caused by lax regulations and inefficiencies in planning, or (3) that these evils are caused by excessive consumerism and amorality among the privileged, or (4) all of the above. Whatever views one has of this issue, the point is that no one's opinions should be shoved down children's throats in the guise of a math lesson.

The *Leave Room for Me!* unit is particularly worrisome because of the current racial climate regarding such issues as immigration. In a demagogic fashion, California Governor Pete Wilson has been blaming the state's economic problems on the increasing Latino immigrant population and has even called for abolition of the provision of the U.S. Constitution that, irrespective of the parents' status, guarantees citizenship to any child born in the U.S. Especially in states like California and Florida, the last thing one should do in high school math class is to encourage racial paranoia about population increase.

Finally, we agree with IMP directors that the mathematical presentation in the revised version of *Leave Room for Me!* is more sophisticated and less simplistic than in the earlier version and no longer implies that the exponential function is the most realistic model for human population growth.

Neal Koblitz
University of Washington
Ann Hibner Koblitz
Hartwick College
Michael R. Fellows
University of Victoria
(Received March 10, 1994)

Erratum

The November 1993 issue of the *Notices* carried an announcement on page 1280 of the recipients of AMS Centennial Fellowship awards. Krzysztof Burdzy (Nineteenth award, 1992–1993) was incorrectly listed as Krzysztof Kurdzy.

Call for Nominations for AMS Prizes

Distinguished Public Service Award
Frank Nelson Cole Prize in Algebra
Ruth Lyttle Satter Prize
Norbert Wiener Prize

The selection committees for these prizes request nominations for consideration for the 1995 awards, which will be presented at the Joint Mathematics Meetings in San Francisco in January 1995. Information about these prizes may be found in the November, 1993 *Notices*, pp 1272-1280.

The *Award for Distinguished Public Service* is presented every two years to a research mathematician who has made a distinguished contribution to the mathematics profession during the preceding five years.

The *Frank Nelson Cole Prizes* are awarded at five-year intervals for contributions to algebra and number theory, respectively.

The *Ruth Lyttle Satter Prize* is awarded every two years to recognize an outstanding contribution to mathematics research by a woman in the previous five years.

The *Norbert Wiener Prize* is normally awarded every five years and is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics for an outstanding contribution to "applied mathematics in the highest and broadest sense".

Nominations should be submitted to the Secretary, Robert M. Fossum, Department of Mathematics, University of Illinois, 1409 West Green Street, Urbana, IL 61801, and should include supporting material. For the Public Service Award, include a short description of the pertinent activities of the nominee; for the Cole Prize, Satter Prize, and Wiener Prize, include a short description of the work that is the basis of the nomination, including complete bibliographic citations. A curriculum vitae should be included for all nominees. The nominations will be forwarded by the Secretary to the appropriate prize selection committee which will, as in the past, make the final decisions on the awarding of the prizes.

Deadline for Nominations is August 30, 1994

Ed Block Commended for Service Upon His Retirement from SIAM

Dr. I. Edward (Ed) Block, Managing Director of the Society for Industrial and Applied Mathematics (SIAM), was presented with a special Citation from the AMS and a Certificate of Merit from the Mathematical Association of America during the Joint Mathematics Meetings in Cincinnati in January 1994. These commendations recognized Dr. Block's vision, hard work, and dedication in building SIAM into an active, respected organization over the past forty years. In July 1993 Dr. Block announced that he would retire from SIAM in August 1994.

Citation from the AMS

The members of the Executive Committee and the Board of Trustees of the AMS extend many thanks and offer best wishes to Dr. I. Edward (Ed) Block, who has retired after serving for forty-two years as managing director of SIAM. They take note of the fact that Dr. Block was a principal founder of SIAM, has served SIAM with distinction, and, while doing so, has maintained excellent relations with the AMS.

Citation from the MAA

More than forty years ago, Dr. I. Edward (Ed) Block had an idea for a new mathematical organization that would foster the application of mathematics in industry. In November 1951, under Ed's guidance, SIAM was born. In the early days, while working full-time as a mathematician at Philco Corporation, Ed operated SIAM out of a spare room in his parents' home—all on a volunteer basis. In 1953, Ed started SIAM's first journal. Today SIAM has ten journals, *SIAM News*, and an active book program. The spare room that SIAM started with would not be adequate for the current fifty-member staff.

Over the years, Ed has started a remarkably large number of new SIAM programs. His energy and attention to detail are legendary. He seems to be involved in every aspect of SIAM's activities.

We are indebted to Dr. Block for remaining true to SIAM's founding purpose and for making us sensitive to the importance of the applications of mathematics. He leaves SIAM and the MAA with a rich legacy. We salute you, Dr. Block, "Mr. SIAM", on a lifetime of enormous accomplishments and contributions to mathematics and industry.

Response from Block

During the Prize Session at the Joint Mathematics Meetings, Dr. Block presented the following remarks:

One of SIAM's goals is to "further the application of mathematics to industry and science." The goal is as valid today as it was [back in 1952].

That mathematical and computational analysis has played a fundamental role in improving industrial products and processes and advancing the understanding of science is unequivocal. Yet, the extent to which mathematicians have gotten credit for their contributions is another matter.

Honoring Ed Block: MAA President Donald Kreider (left), AMS President Ronald Graham (center) with Ed Block.

For some mathematicians, mathematics is proving theorems or teaching; for others it is problem solving, but there are not many problem solvers who carry the title "mathematician". Industry managers do not seem to think of mathematicians when they hire people to solve problems.

And conversely, there is a paucity of jobs for mathematicians, not only in industry, but also in the university. I am sure most of you are aware of the "Concerns of Young Mathematicians" e-mail network, whose members are using the Internet to discuss their job problems and to bring their predicament to the attention of their teachers and others. The problems are coming at a time when industry is downsizing and jobs are tight not only for mathematicians but also for engineers and scientists.

Two of these young mathematicians have submitted a petition about the current hiring practices of the universities to the AMS Council for consideration here at this meeting. I believe it is also on the "Concerns" network. Their message is cogent: "It is incumbent on mathematics departments to make all their potential Ph.D.s aware of the realities of the job market and to encourage them to prepare for a broad range of jobs in the mathematical sciences."

Surely this is a valid view. Those in the community who want to be responsive to this message will need to find out a lot about the payoffs of mathematical and computational analysis, for example, in industry and will need to take steps to change the educational program for those students who desire nonacademic careers. This will not be easy, but if you are a believer, as I am, the rewards will be there.

Biographical Sketch

Dr. I. Edward Block received his bachelor's degree in physics from Haverford College in 1944. He moved to Harvard University for graduate work and there received a master's degree (1947) and a Ph.D. (1952), both in mathematics. His doctoral thesis advisor was Joseph L. Walsh.

From 1951 to 1954 he was a mathematical consultant for Philco Corporation in Philadelphia, where he solved problems concerning the design of electrostatic speakers, nonlinear detectors, and computer-based ray tracings for color television tubes. He founded SIAM in 1951 and built the organization over twenty-five years while also working in various positions in industrial mathematics; it was not until 1976 that working for SIAM became his occupation. SIAM was incorporated in the state of Delaware on April 30, 1952.

From 1954 to 1959 Dr. Block worked for the Burroughs Computation Center in Philadelphia, managing a group of analysts and programmers working on mathematical analysis, programming, and computer services to local industry on a 1956 vintage core memory/drum storage computer. He spent the next three years at the Univac Division of Sperry-Rand Corporation, where he organized, implemented, and operated the computer services center for the engineering division. He became the manager of the applied mathematics division of that company in 1962, where he oversaw a group of analysts, programmers, and system designers who designed and implemented computer software for such applications as a satellite navigation system, classroom scheduling, revenue monitoring, fault isolation, and orbit computations. In 1964 he moved to the Auerbach Corporation first as a staff consultant and then as vice president and manager of Auerbach Info, Inc. In 1972 he became vice president and director of the company's product planning and development. Since 1976 he has served as managing director of SIAM.

American Mathematical Society National Policy Statement 1994–1995

In January 1993, the Federal Policy Agenda Subcommittee of the Committee on Science Policy began work on a document that would provide a framework in which to articulate public policy issues for the mathematical sciences. The results of these efforts are the two documents that follow: National Policy Statement 1994–1995 and Summary. The National Policy Statement sets forth specific goals for the AMS to work toward in order to strengthen the mathematical sciences. The statement also provides information to federal agencies about the support needed for the mathematical sciences to remain a strong contributor to the solution of national problems. At its meeting in April 1994, the AMS Council approved the National Policy Statement as an official document representing the views of the AMS.

The members of the Federal Policy Agenda Subcommittee are:

Hyman Bass, Columbia University
John Bradley, AMS
Arthur Jaffe, Harvard University
Linda Keen, City University of New York
John Morgan, Columbia University
John Polking, Rice University
Frank Warner, University of Pennsylvania (chair)
Margaret Wright, AT&T Bell Laboratories
Robert Zimmer, University of Chicago

What follows is first the Summary and then the full text of the National Policy Statement.

American Mathematical Society National Policy Statement 1994–1995 Summary

The American Mathematical Society

Founded in 1888 to further mathematical research and scholarship, the 30,000-member American Mathematical Society (AMS) fulfills its aims through programs and services that promote mathematical research and its uses, strengthen mathematical education, and foster awareness and appreciation of mathematics and its connections to other disciplines and everyday life. This policy statement affirms that research within mathematics, the application of mathematics in other disciplines, and the teaching of mathematics are interdependent—nourishing each other with ideas, methods, and inspiration. None of these components of the system—research, application, education—can be neglected without weakening the others.

Purposes of the National Policy Statement

- To articulate public policy issues of significance for the mathematical sciences.
- To inform public policy makers and the public about these issues.
- To help formulate goals at the national level and set priorities for their accomplishment.

Goals and Recommendations

I. Maintain the Highest Level of Excellence in Mathematical Sciences Research

- Promote a federal science policy in which maintenance of research strength across the breadth of the mathematical sciences, with the support necessary for clear world leadership, is an integral component.
- Urge Congress and federal agencies to nurture the fundamental enabling role of the mathematical sciences by strong support of basic investigator-driven research.
- Advocate that stable, reliable funding be provided for outstanding mathematical sciences research.

National Science Foundation (NSF)

– Urge the federal government to preserve as the central mission of the NSF the support of basic research and the education of future scientists and engineers.
– Promote a science policy that allows the NSF to determine the optimal allocation of its budgeted funds.

Mission Agencies

– Encourage dialog with mission agencies on broader participation by mathematical scientists in agency projects.

– Enlist the mission agencies in supporting the recruitment and training of young people in the mathematical sciences.

Human Resources
– Urge federal agencies to expand postdoctoral programs in the mathematical sciences in order to provide continuing professional development in research, education, and application of mathematics.
– Seek and support mechanisms to increase the representation and advancement of women and underrepresented minorities in the mathematical sciences.
– Seek innovative and productive ways to use the talent of young mathematicians, which is a vital national resource.

Communications Networks
– Support federal programs and policies that will enhance development of communications networks and technologies.
– Facilitate access to electronic communication for mathematics researchers, educators, and students.

II. Connect the Power of Mathematics and Mathematical Thinking to Problems in Science, Technology, and Society

Federal Science Initiatives
– Urge federal agencies to ensure that active research mathematicians are included in the creation and planning of federal science initiatives.
– Seek to facilitate the engagement of mathematical scientists in federal science and technology initiatives.

Connections with Other Disciplines
– Enlarge the scope and extent of interdisciplinary research connecting mathematics with other fields.
– Emphasize the value of such connections during the mathematical training of both undergraduate and graduate students.

Industrial Mathematics
– Support the creation of formal liaisons between industry and academic mathematical scientists, including industrial internships and postdocs.

III. Strengthen all Levels of Mathematics Education

- Encourage greater participation by research mathematicians in the reform of mathematics education at all levels, with particular attention to the professional development of teachers.

Graduate Education
– Promote the enrichment of graduate programs in mathematics to provide students with a more versatile range of mathematically-based professional skills.
– Encourage development of diverse Master's Degree programs, based on sound training in the core mathematical disciplines, to offer a wider choice of professional careers, including teaching.

Undergraduate Education
– Support efforts to review and reform the undergraduate mathematics curriculum, in response to changing student and national needs.
– Foster wider understanding and appreciation of mathematics as a creative discipline, in particular through its presentation in undergraduate mathematics instruction, including undergraduate research.
– Encourage increased attention to and professional development of pedagogical performance of both faculty and graduate students.

K–12 Education
– Encourage greater participation by researchers in standards-based reform of K–12 mathematics education, particularly by strengthening the disciplinary foundations of the standards.
– Promote more active participation by mathematicians in programs for the professional development of teachers.

Valuing Education in the Mathematical Culture
– Stimulate discussion and experimentation in the mathematics community leading towards appropriate forms of professional assessment of educational performance.

IV. Communicate the Nature of the Mathematical Sciences and How Mathematics Contributes to Society

- Promote understanding of mathematics by encouraging the output of high-quality expositions for students at all levels, the general public, policy makers, and other scientists and engineers.
- Stimulate the production of expository articles on the fundamental ideas of mathematics and their pervasiveness in modern life.
- Convey to the public—and especially to children and to the teachers of children—that mathematics is a creative discipline involving discovery in which they can participate.
- Foster public understanding of the beauty and power of mathematics and its role as a fundamental mode of human thought.

Toward the Year 2000
– Join with the International Mathematical Union (IMU) in celebrating the year 2000 as World Mathematics Year.
– Participate in this international effort to review the achievements of the mathematical sciences in the twentieth century, to celebrate the contributions of mathematics to human society, and to articulate some of the major challenges for mathematics as we enter the twenty-first century.

American Mathematical Society National Policy Statement 1994–1995

The American Mathematical Society

Founded in 1888 to further mathematical research and scholarship, the 30,000-member American Mathematical Society (AMS) fulfills its aims through programs and services that promote mathematical research and its uses, strengthen mathematical education, and foster awareness and appreciation of mathematics and its connections to other disciplines and everyday life.

Purposes of the National Policy Statement

- To articulate public policy issues of significance for the mathematical sciences.
- To inform public policymakers and the public about these issues.
- To help formulate goals at the national level and set priorities for their accomplishment.

The Mathematical Sciences

Mathematics, the study of measurement, forms, patterns, and change, evolved from efforts to describe and understand the natural world. Over the course of time it has developed a rich and sophisticated intrinsic culture that feeds back into the natural sciences and technology, often in unexpected ways. Mathematics now reaches far beyond the physical sciences and engineering into medicine, business, and the life and social sciences. Its influence has been vastly enlarged by the advent of modern computers, whose use in problem-solving, simulation, and decision-making relies on powerful computational algorithms derived from continuing new developments in fundamental mathematical theory.

Research in the mathematical sciences is typically conducted by individuals working alone or in small, collaborative groups. Taken together, these individuals and groups constitute a human and intellectual resource of national significance. The AMS therefore considers the professional community of mathematicians a proper subject of national science policy.

Most researchers in the mathematical sciences are also educators: of scientists and engineers, of future mathematicians, of teachers at all levels, and, indeed, of nearly every post-secondary student. Mathematics is the most teaching-intensive of the sciences, reflecting its fundamental enabling role. Education has historically been a high professional calling for mathematicians, one that is now being reinvigorated as the nation's educational system is reformed at all levels.

Research within mathematics, the application of mathematics in other disciplines, and the teaching of mathematics are interdependent—nourishing each other with ideas, methods, and inspiration. Individual mathematicians are typically involved in several of these activities. To be properly understood, mathematics must be viewed as a synergistic system in which none of these components can be neglected without weakening the others.

Goals

I. Maintain the highest level of excellence in mathematical sciences research.

II. Connect the power of mathematics and mathematical thinking to problems in science, technology, and society.

III. Attain excellence at all levels of mathematics education, giving particular attention to the professional development of teachers.

IV. Communicate the nature of the mathematical sciences and how mathematics contributes to society.

I. Research in the Mathematical Sciences

Substantial attention has been devoted recently to re-examining the rationale for federal support of scientific research. Much of the discussion stresses that federally funded scientific research should contribute to the improvement of society and to the pursuit of national goals. The mathematical sciences play such a fundamental role in all fields of science and engineering that their vitality is both essential to and dependent on a thriving atmosphere for research that addresses U.S. national needs.

- Maintaining research strength across the breadth of the mathematical sciences, with the support necessary for clear world leadership, must be an integral component of federal science policy.

As the primary U.S. professional organization dedicated to the advancement of basic research in the mathematical sciences,

- the American Mathematical Society has as its principal goal the highest level of excellence in mathematical sciences research.

Developments in the mathematical sciences often have major, multiplicative effects, direct and indirect, on other areas of science and technology. However, some parts of mathematics research do not produce an immediate, visible impact; in addition, it is impossible to predict reliably which mathematical underpinnings will be critical in the future. For these reasons, there is a serious danger of neglecting fundamental research in primary areas in favor of more directed payoffs. Such a policy would damage the long-term health of our nation's science and technology. The mathematics that underlies quantum mechanics, relativity theory, modern computers and the communications and information revolution, the CAT scan, modern economic theory, the mathematical analysis of DNA replication, the large-scale computation of fluid dynamics or wave propagation, and other major achievements was in many of these instances developed separately and well in advance of the application.

- The AMS urges Congress and those federal agencies that support research and development to nurture the fundamental enabling role of the mathematical sciences by strong support of basic investigator-driven research.

Mathematics aims not only to solve specific problems, but also to find global and synthesizing structures that unify apparently disparate phenomena. The power and perspective afforded by such structures often contribute to the solution of problems previously viewed as unrelated and intractable.

- Since major advances in mathematics typically involve sustained effort over a number of years, the AMS advocates that stable, reliable funding be provided for outstanding mathematical sciences research.

National Science Foundation

In the years following World War II, our national leadership wisely recognized the need to create an institutional refuge where basic science could be nurtured and sheltered from the winds of political change. That refuge is the National Science Foundation (NSF), the only federal agency primarily charged with sustaining the quality and vitality of basic research across all of mathematics, science, and engineering. The NSF is a relatively small, but absolutely vital and highly cost-effective investment that has served our nation well. The integrity of its enlightened founding mission is particularly important for the mathematical sciences.

– The AMS urges the federal government to preserve the support of basic research and effective education of future scientists and engineers as the central missions of the National Science Foundation.

While it is appropriate for the NSF to encourage some thematic research and strategic initiatives, it is important to strike a proper balance. This is impossible to achieve when the budget process systematically shelters only strategic programs. If the economic environment imposes austerity, then it is all the more important that the foundation have the flexibility to manage programs without unhealthy distortion.

– The AMS urges the federal government to promote a science policy that allows NSF flexibility to determine the appropriate balance among research programs.

Mission Agencies

The mission agencies have for many years supported a mixture of basic and focused research. The long-term effectiveness of these mission efforts depends on the health and continuing enrichment of the basic mathematical culture. The continued well-being of mathematics is therefore an indirect, but significant, concern of the mission agencies.

– The AMS will encourage increased dialog with the mission agencies in exploring opportunities for broader participation by mathematical scientists, and in supporting the recruitment and training of talented young people in the mathematical sciences.

Human Resources

Many reports have recommended an increase in postdoctoral positions in the mathematical sciences. The 1992 report by the National Research Council (NRC), "Educating Mathematical Scientists: Doctoral Study and the Postdoctoral Experience in the United States," documents the lack of such postdoctoral positions and describes them "as the logical step after completion of the doctorate for the good student, not as a highly competitive prize for a select few." The report concludes that postdoctoral fellowships "could form a bridge to future careers in which teaching or applications are important."

A suitably expanded postdoctoral program will contribute to the profession and to society by allowing more mathematics Ph.D.s to establish productive careers in academic or industrial research, teaching, education, or the application of mathematics to other disciplines.

– The AMS urges federal agencies to support expanded postdoctoral programs in the mathematical sciences to provide continuing professional development in research, education, and the applications of mathematics.

A significant human resource issue for the mathematical sciences is the continuing underrepresentation of women and minorities. A complex set of factors, taking place at all stages of the educational ladder, serves to discourage their participation and continuation.

– The AMS is committed to working with other organizations and with federal agencies to seek and support programs and activities to increase the representation and advancement of women and underrepresented minorities in the mathematical sciences.

At present, two conditions have created an oversupply of Ph.D.s in portions of the mathematical sciences. One is the retrenchment in educational institutions caused by the weak U.S. economy. The second is the large influx of foreign mathematicians produced by the events following the end of the Cold War and more open relations with China. The resulting difficult job market, coupled with the reduction in the number of supported investigators in core disciplinary areas, is having a profoundly depressing effect on young mathematicians.

– The talent of the nation's young mathematicians is an important national asset. WE MUST FIND PRODUCTIVE WAYS OF USING IT.

Communications Networks

A revolution in electronic communications and information retrieval has begun. As communications networks and technologies grow larger and more versatile, they will become an increasingly significant portion of the infrastructure for research and education. The AMS supports federal programs to increase the capabilities of electronic networks for transmission of text, video and sound, to develop more powerful tools for data retrieval, and to expand access to the networks to all portions of the research and education communities.

– The AMS supports federal programs and policies that will make access to modes of electronic communication available to all researchers, educators, and students and that will speed development of the electronic networks.

II. Applications to Science and Technology

Initiatives

Federal initiatives, often encompassing support by several agencies, are a growing feature of science funding. The strategy of constructing broad research programs focused on major national problems has several obvious advantages: initiatives draw attention to problems, encourage multidisciplinary collaborations, and produce opportunities for intellec-

tual cross-fertilization. Although the mathematical sciences are important in essentially all existing initiatives, active research mathematicians are often not involved in the initial design and planning. Participation by mathematical scientists at the early stages will contribute to the success of these initiatives.

- The AMS urges federal agencies to ensure that active research mathematicians are included in the creation and planning of federal science initiatives.
- The AMS, through its programs, publications, and meetings, will seek to facilitate the engagement of mathematical scientists in federal science and technology initiatives.

Connections with Other Disciplines

The research of many mathematical scientists is linked to other fields. For these mathematicians, cross-disciplinary contributions and mathematical achievements are inseparable. But the outreach of mathematics is not limited to settings where the interdisciplinary context is known in advance. A common experience of mathematical scientists is the discovery that some research in mathematics has been absorbed by other scientific disciplines to such an extent that the mathematical foundations are obscured. In the other direction, insights and techniques from many areas have inspired mathematical research that has taken on a life of its own, independent of the field of origin. It is the view of the AMS that many of the nation's problems could benefit from increased attention by mathematical scientists. However, a long history of collaborative experience indicates that substantial groundwork is often necessary to understand and define common issues. In the belief that mathematics research will continue to offer opportunities for productive and effective interdisciplinary activities,

- the AMS will cooperate in working with federal agencies and policy-makers, and with university mathematical sciences departments, to enlarge the scope and extent of interdisciplinary research connecting mathematics and other fields. Such connections should also find expression in the mathematical training of both undergraduate and graduate students.

Industrial Mathematics

The needs of U.S. industry are increasingly cited as one of the primary justifications for federal support of scientific research. However, effective mechanisms for direct technology transfer are far from simple. The AMS favors increased interaction between mathematical sciences research and industry, and will work with other societies such as the Society for Industrial and Applied Mathematics (SIAM) to enhance these opportunities. Federal support for such interactions might take several forms. In particular,

- the AMS supports programs that facilitate the creation of formal liaisons between industry and academic mathematical scientists, including industrial internships and postdocs.

III. Mathematics Education

American education in mathematics and science is in a state of reform at all levels, kindergarten through graduate school. In the technological economy to which this country aspires, many citizens will require substantial technical knowledge and reasoning skills, and the flexibility to adapt to different jobs and even different careers. In particular, such competence must be broadly achieved by women and underrepresented minorities, the very populations for whom mathematics and science education has historically been least successful. This situation poses a challenge that must be addressed by the entire community of teachers, including those in colleges and universities.

A comprehensive and integrated reform—of curricula, pedagogy, assessment methods, teacher professional development, and the cultural value placed on education—is required. In scientifically-oriented education, where mathematics is foundational and pervasive, mathematics educators have a special, even primary, responsibility in meeting this challenge. In this effort the AMS will join forces with other more educationally-focused organizations, including the Mathematical Association of America (MAA), the American Mathematical Association of Two Year Colleges (AMATYC), the National Council of Teachers of Mathematics (NCTM), and the Mathematical Sciences Education Board (MSEB).

Mathematicians can play an important role in educational reform by furnishing disciplinary expertise that informs the development of curricula, assessment materials and disciplinary teacher training. They can also help to communicate the power and creative nature of mathematics, and to enliven the classroom experience with issues of contemporary research.

- The AMS will encourage increased participation of research mathematicians in the comprehensive reform of mathematics education at all levels, and will support federal programs to facilitate that participation.

Graduate Education

American universities have led the world in training mathematicians in the core disciplines for careers as research-scholars in universities and research labs. However, the traditional academic job market is contracting. Mathematically-trained students are increasingly finding employment in colleges without graduate programs, in two-year colleges, or in nonacademic environments where mathematics is not the primary focus. Graduate programs in mathematics should, accordingly, provide students with more versatile professional skills, in forms that may vary among institutions and regions. Building upon the recent NRC report "Educating Mathematical Scientists: Doctoral Study and the Postdoctoral Experience in the United States",

- the AMS will promote the enrichment of graduate programs in mathematics in order to provide students with a more versatile range of mathematically-based professional skills.

This broadened graduate training might typically include courses in probability and statistics, theoretical computer science, and especially in pedagogy and communication. Such enhancement of core subjects could furnish a range

and depth of skills at the Master's level for which there are increasing employment opportunities in a variety of fields.

– The AMS encourages the development of strong Master's Degree programs designed for diverse professional preparation, including teaching careers, based on sound training in the core mathematical disciplines.

Undergraduate Education

The changes in career opportunities and in technology that are affecting graduate education have prompted a rethinking of undergraduate pedagogy as well. The first efforts at undergraduate education reform have focused on calculus. Various pilot projects have already produced calculus curricula that are available for wider trial and development. More systematic review of the whole undergraduate program, for the general mathematics student as well as the major, is now being initiated.

– The AMS, in cooperation with the MAA, SIAM, and other professional organizations in the mathematical sciences, supports efforts to review and reform the undergraduate mathematics curriculum, in response to changing student and national needs.

For teachers of mathematics, the primary model of professional instruction comes from undergraduate mathematics courses. In view of the pressing need for improved disciplinary training of school teachers, it is all the more important that we seek a high level of instructional performance in undergraduate courses.

– The AMS encourages increased attention to and professional development of pedagogical performance of both faculty and graduate students.

Mathematical research has a largely unfulfilled contribution to make to undergraduate education. Ideally, all college-educated Americans should be aware of the liveliness of today's mathematical sciences research, which occupies a large international community of scholars and supports the technologies that continue to transform our world. Researchers can enhance this awareness by describing their own work and encouraging more research by students.

– The AMS will foster wider understanding and appreciation of mathematics as a creative discipline, in particular through its presentation in undergraduate mathematics instruction.

– The AMS endorses the value of undergraduate research experience in the mathematical sciences.

K–12 Education

The mathematics teaching community has initiated extensive reforms of mathematics and science education in the schools. This effort is aligned with the NCTM national standards for curriculum and teaching and the emerging standards for assessment.

These standards provide an unprecedented national framework to guide K–12 mathematics education reform; however, they should not be viewed as definitive or fixed. The research community has much to contribute in reviewing these standards and much to gain by learning about and contributing to the pedagogical and assessment aspects of reform.

– The AMS encourages increased participation of the research community in the national standards-based reform of K–12 mathematics education, particularly through strengthening the disciplinary foundation of the standards.

The professional development of teachers, both preservice and in-service, is the central and most formidable task facing school mathematics reform. Mathematicians, through their disciplinary expertise, have much to contribute to that effort. They can help develop new curricular and assessment materials; they can work cooperatively with teachers and schools in their local communities; they can participate in workshops for teachers; and they can interact with school teachers in shared professional environments, such as the vertically integrated regional geometry institutes.

– The AMS will support increased participation of mathematicians in programs for the professional development of teachers of mathematics.

Valuing Education in the Mathematical Culture

Just as scholarly research is professionally valued, professionally assessed, and professionally rewarded, so also must educational performance be valued, assessed, and rewarded if we are to achieve the educational quality now called for. Educational performance is here meant to include not only classroom teaching, but also activities such as curriculum development, program design, and educational research. A basic problem is to develop appropriate forms of professional assessment of teaching growth and effectiveness that, for educational performance, can function as do peer-review and archival publication for scholarly research. To this end, and with the goal of ultimately achieving this important change in our professional culture,

– the AMS will stimulate discussion and experimentation in the mathematics community leading towards appropriate forms of professional assessment of educational performance.

IV. Communication

The AMS recognizes the challenges in conveying to other scientists and engineers, to the public, and to policy makers the nature of the mathematical sciences, how they are serving the goals of society, and how in the future they will serve these goals in new and remarkable ways. The potential value of such awareness is illustrated by well-known examples of scientists in other disciplines discovering that "the mathematicians have been here before." A significant goal of the AMS is to reduce the time for assimilation of mathematical results into other disciplines.

- The AMS will promote understanding of mathematics by encouraging the output of high-quality expositions for students at all levels, the general public, policy makers, and other scientists and engineers.

  As a special part of this effort at communication,
- the AMS will join with other professional organizations in the mathematical sciences to stimulate the production of

expository articles on the nature of the fundamental ideas of mathematics and their pervasiveness in modern life.

A particular challenge will be to convey to the public, and especially to children and to the teachers of children, that mathematics is a creative discipline involving discovery in which they can participate.

Mathematical inquiry is a fundamental mode of human thought. Its roots go too far back in pre-history to trace, but an unbroken chain of such inquiry has continued for more than two thousand years, from Greek civilization at the time of Euclid. The end of this chain, modern mathematics, is not only a subject of tremendous usefulness and a basis for investigations in many fields, scientific and otherwise, but is itself one of the great products of the human intellect.

- The AMS will foster public understanding of the beauty and power of mathematics and its role as a fundamental mode of human thought.

Toward the Year 2000

The passing of a millennium is an extraordinary occasion for reflection and challenge. The International Mathematical Union (IMU) has declared the year 2000 to be World Mathematics Year.

– The AMS will join in this international effort to review the achievements of the mathematical sciences in the twentieth century, to celebrate the contributions of mathematics to human society, and to articulate some of the major challenges for mathematics as we enter the twenty-first century.

Recognition and Rewards in the Mathematical Sciences

New Report Examines the Rewards System in Departments and Provides Guiding Principles for Change

How can mathematical sciences departments evaluate and reward the full range of faculty activities? How can teaching be evaluated? What constitutes "scholarship"? How should service to one's institution or to the profession be rewarded? How should departments balance research, teaching, service, and scholarship in making decisions about promotions, tenure, and salary increases?

Such questions have long been the subject of debate within the mathematical sciences community and within academia more generally. But today the debate is taking on added urgency as colleges and universities struggle to respond to increasing demands from government and the general public. A number of reports, most notably "Scholarship Reconsidered: Priorities of the Professoriate", by Ernest Boyer, have explored the question of what constitutes scholarship and what the appropriate balance is between teaching and research.

The mathematical sciences community has attempted to take the lead in examining these issues. The Committee on Professional Recognition and Rewards of the Joint Policy Board for Mathematics was established in 1991 to examine the rewards systems currently in place in mathematical sciences departments and to formulate guidelines to assist departments in making decisions about their rewards systems. With funding from the National Science Foundation and the Exxon Education Foundation, the Committee carried out site visits to twenty-six institutions, as well as a survey of nearly 2,000 mathematical sciences faculty and over 600 chairs in departments of various types (including Ph.D.-granting and bachelor's-granting institutions and two-year colleges). In presentations at numerous meetings and conferences, the Committee aimed to inform the mathematical sciences community about its work. The culmination of these efforts is the report "Recognition and Rewards in the Mathematical Sciences", which will be released in early May.

The report does not contain a "blueprint" for a rewards system. Indeed, the Committee was very much aware that no single rewards system could be workable in all mathematical sciences departments in all kinds of institutions. Rather than making prescriptive recommendations, the report provides guidelines that any department can use as a basis for discussions about how to craft a rewards system that serves well its faculty, its institution, and its constituents. The guidelines could also be used in negotiations between departments and administrations about changes in the rewards system.

The Report's Findings

The first section of the report presents ten findings which describe what the Committee observed on its site visits and in its survey. The findings provide a look at rewards systems as they operate in mathematical sciences departments today—how faculty feel about them, what influences rewards systems, how they are changing. As might be expected, research plays a central role in the rewards systems at most institutions, and faculty believe that this is as it should be. The survey asked about the importance to rewards systems of three kinds of research: research in the discipline, interdisciplinary research involving new mathematics, and applications of existing mathematics to other fields. The survey found widespread agreement that research in the discipline is very important. Interdisciplinary and applied research were also viewed as important, though not as important as research in the discipline.

The report indicates that, despite the general consensus about the importance of research, most faculty would like to see a broader and more flexible rewards structure that values not just research, but also teaching, scholarship, and service. In particular, there is a wide array of activities which many faculty believe should count for more in the rewards system; these activities include classroom teaching, service to the institution or to the profession, interdisciplinary research, research on educational issues, expository writing, and student mentoring and advising. Sometimes the rewards system can actually discourage work in these areas, even when the work is extremely important to the department and the institution. The report particularly notes a "great dissatisfaction about inadequate rewards for faculty's educational responsibilities."

Despite these tensions, there have been changes in the last five to ten years. In particular, the report points out a gradual evolution in mathematical sciences departments along two parallel tracks: Departments which traditionally emphasized teaching are placing heavier emphasis on research, while departments which traditionally emphasized research are placing greater emphasis on teaching. In teaching departments, the report says, "These changes were recent enough to cause consternation among junior faculty members over exactly

what was expected of them in order to gain tenure and whether these expectations were changing as they progressed toward tenure." In research departments, the new emphasis on teaching was "more evident in the rhetoric than in the actual policies, [but] this emphasis is definitely working its way into the rewards structure."

The report outlines a number of difficulties associated with making changes in the rewards structure. First, there is little consensus within the mathematical sciences community about how to evaluate many professorial duties. Research emerged as the activity that faculty are most comfortable about evaluating, but, the report says, "even this came under attack in some quarters. It was felt that a certain amount of publication, as well as invitations to conferences and giving colloquiums and seminars, could be achieved through cronyism." However, the report notes, whatever the problems are with evaluating research, they have not prevented research from gaining high importance in the rewards system.

With teaching, the situation is the opposite: Perceived difficulties with evaluating teaching, the report states, "emerged as a fundamental stumbling block in efforts to increase the importance of teaching in the rewards structure." In particular, the student evaluation questionnaire—the single most frequently used method of evaluating teaching—was viewed with great suspicion. The report quotes one faculty member's assessment of what usually happens with student evaluation questionnaires: "If the student fails, I fail." When it comes to evaluating activities such as service to the institution or to the profession, "There was usually not even an attempt formally to measure effective work."

Another barrier to changing the rewards system is the uncertainty about what should be included under the rubric "scholarship". The report notes that this uncertainty is less pronounced in research-oriented departments, where scholarship is usually assumed to mean publishing traditional research articles in refereed journals. The Committee's site visits revealed that most departments do not have a working definition of scholarship. Although there seems to be agreement that scholarship implies some sort of active engagement with the discipline, there are varying views on exactly what kinds of activities should be considered scholarship and how they should be rewarded.

Lack of communication between various organizational levels is a major problem at many institutions, the report notes, and one that can hamper efforts to change the rewards system. Often there is a lack of understanding about the relative values that institutions placed on teaching, research, and service. "One assistant professor told us that teaching was absolutely the main consideration in the tenure decision," the report says, "while another in the same department told us the main consideration was research." There are often disparities in goals: "In some places it was apparent that the department and the administration were working on totally different agendas, and neither knew what the other's was."

The fewest communication problems were found in institutions with the most effective department chairs, the report says. Acting as the interface between the department and higher administration, chairs can have a great deal of influence over the well-being of the department. "Unfortunately," the report notes, "chairs commonly have no systematic training to prepare them for this role." An interesting finding about chairs emerged from the survey. Faculty and chairs were asked whether salaries reflect differences between excellent and average teaching. In every type of institution, the percentage of chairs who answered "yes" was close to double that of the faculty.

What kinds of rewards do faculty want? The report states that, when it comes to salary raises, most faculty prefer a rewards system that combines across-the-board and merit salary increases. In addition, the report says that the general "quality of life" in the department emerged as a reward much valued by faculty. Quality of life rewards can take many forms, tangible and intangible: offices, classrooms, parking, clerical help, computer facilities, congeniality within the department, good communication with the administration, and appreciation from colleagues and the chair. "The most common reason for low quality of life in departments was lack of appreciation of the department by the administration," the report states.

Recommendation and Guiding Principles

Because of the great diversity of institutions and departments, the report avoids making pronouncements about what departments should do. However, it does state one general recommendation: "The recognition and rewards system in mathematical sciences departments must encompass the full array of faculty activity required to fulfill departmental and institutional missions." In addition, the report sets forth six Guiding Principles to assist mathematical sciences departments in considering changes in their rewards systems.

Three of the Guiding Principles have to do with what kinds of activities should be rewarded. The report points to research as the fundamental raison d'être of the discipline and states that research should be among the primary factors of importance in any rewards system. There must be internal strength in core areas of the discipline as well as "lively connections to other disciplines and to business and industry," the report states. In addition, "No distinction should be made in the rewards system between research in the core areas of mathematics and that in applied areas." The report suggests that joint appointments, with joint evaluations, can help interdisciplinary research to thrive.

Two other primary factors of importance in any rewards system are education and service. Although there may be more or less emphasis on research depending upon the department and the institution, teaching is a major responsibility in every department. Therefore, the report states that, in all departments, "the teaching function should be viewed as a primary responsibility of all faculty and should be rewarded and recognized accordingly." Departments should help faculty and graduate students improve their teaching by having those acknowledged to be excellent teachers share their expertise or by calling upon such campus resources as teaching centers.

In the realm of service, the report points to a variety of activities that are crucial to departments and their institutions and which should be valued as important components of a rewards system. These include: chairing the department, managing the undergraduate or graduate programs, serving on departmental or institutional committees, recruiting and mentoring minority and women students and scholars, and assuming leadership roles in professional organizations.

Scholarship should also be an important factor in any rewards system. The report suggests that every faculty member should be engaged in some form of scholarship. In some departments traditional research may be the primary mode of scholarship, while in others it might be more appropriate to adopt a broader definition of scholarship that encompasses such activities as writing textbooks and expository papers, public awareness efforts, curricular development, improving teaching methods, and research in mathematics education. The report also suggests that rewards systems be flexible enough to allow faculty to shift to different forms of scholarship during their careers. Noting that no one definition of scholarship will be right for every institution, the report includes in an appendix a proposal for a definition of scholarship that could be used as a platform for further discussion and refinement within individual departments and institutions.

For a rewards system to work, there must be accepted methods for evaluating various activities. In particular, the report notes that the lack of such methods can prevent some professorial activities from being properly rewarded. For example, the report says, "The perceived inability to evaluate teaching is one of the major stumbling blocks to making teaching an integral part of the rewards system in mathematical sciences departments." The report states that departments should not allow imperfections in evaluation methods to impede progress in broadening the rewards structure. National leadership on the issue of evaluation would help, the report says, proposing that the professional societies could assess evaluation methods currently in use and provide guidelines, models, or suggestions.

Mathematical sciences departments have a wide array of responsibilities connected to research, to students, to their institutions, to the profession, and, depending upon the department and the institution, to the local community and the nation. "The optimal strategy for meeting these varied departmental responsibilities is not to expect all faculty members in the department to do all things at all times," the report notes, "but rather to match faculty work with faculty interests.... But, in order to work, this approach must be accompanied by a rewards system that recognizes excellent contributions to all facets of the departmental mission." In addition, a hallmark of academia is that not everyone need fit into the same mold. "[R]ather than codifying every aspect of a rewards system," the report declares, "departments should formulate clear and flexible policies."

The rewards system should be consonant with the departmental mission and the mission of the institution, the report states. Departments must examine whether the needs of their constituencies are being met and must make the rewards structure responsive to those needs. In addition, clear lines of communication are important. All concerned—faculty, chair, and administration—should know and understand what is valued and rewarded. The report particularly stresses the importance of the department chair in the implementation of any rewards system. "Care in the selection and training of the chair is an important factor in the health and well-being of the department," the report states, suggesting that the mathematical sciences community should organize more workshops for chairs and other training and development mechanisms.

Distribution Plan

At the time of this writing, the report had not been printed but was scheduled to be mailed to all mathematical sciences departments in the nation in early May 1994. The report will also be sent to news publications that carry stories about academia, as well as to certain government offices and agencies and other professional societies in the sciences; a press conference is also planned. In addition, now that the Committee has finished its work, JPBM has started to build on the momentum begun by the report by planning such follow-up activities as regional workshops for department chairs and case studies of rewards systems currently in place in various institutions. Discussions have begun about organizing a task force on the evaluation of teaching.

Those wishing copies of the report should write to: American Mathematical Society, 1527 Eighteenth Street, NW, Washington, DC 20036; e-mail `amsdc@math.ams.org`. The report (without accompanying figures) is also available on e-MATH. To access e-MATH, type **telnet e-math.ams.org**. The login and password are **e-math**. For more information, send e-mail to `support@e-math.ams.org`.

Allyn Jackson

New Mathematical Sciences Curriculum Initiative at the NSF

AMS and MAA Team Up to Offer Workshop to Spark Discussion and Focus Ideas

The National Science Foundation (NSF) has launched a major new initiative that should be of interest to every mathematical sciences department in the country. The initiative, entitled Mathematical Sciences and Their Applications Throughout the Curriculum, will fund large-scale, interdisciplinary, educational projects at the undergraduate level. The basic goal of the program is to increase students understanding of mathematics and their ability to apply mathematics in other disciplines. This initiative differs from the NSF's calculus reform efforts in that projects funded under this initiative should aim at comprehensive, coordinated change involving more than one course (most likely several courses) and should have strong participation by faculty from other disciplines. The NSF is insisting upon serious dissemination plans to insure nationwide impact so that the projects will have influence far beyond the confines of the institutions receiving the grants.

The NSF expects to fund a few projects at the level of about $1 million per year for three to five years. Formal proposals are due in February 1995; proposals for $50,000 planning grants are due June 6, 1994. Instructions about how to obtain program announcements and additional information are at the end of this article. (See also "Dear Colleague Letter: NSF Initiative in Undergraduate Mathematics Education" in "Funding Information for the Mathematical Sciences" in this issue of the *Notices*.)

In order to inform the mathematical sciences community about this initiative, the AMS and the MAA teamed up to organize a workshop entitled "Changing Collegiate Education: Mathematical Sciences and Their Uses in Other Disciplines". Held March 27-28, 1994, in Washington, DC, the workshop brought together about 130 participants who listened to presentations about how such large-scale projects can be organized and who asked questions about the initiative. What follows is a report about the conference.

What the NSF is Looking For

The new initiative is a cooperative effort of NSF's Course and Curriculum Development (CCD) Program, which is part of the Division of Undergraduate Education (DUE) of NSF's Directorate for Education and Human Resources, and the NSF's Division of Mathematical Sciences. An outgrowth of the NSF calculus reform program, CCD funds projects in all disciplines to improve undergraduate science and engineering courses. The new initiative is an attempt to build on these improvements through coordinated, comprehensive reform of a large number of courses that use the mathematical sciences. CCD has launched an analogous initiative in chemistry that is further along than the mathematical sciences initiative: out of 120 proposals for planning grants for the chemistry initiative, CCD recently made fourteen awards.

Robert F. Watson, director of DUE, noted that the initiative is *not* a replacement for calculus reform projects, but rather is a natural sequel. One of the motivations behind the initiative is the common complaint that students do not possess enough mathematical and quantitative skills to handle problems in the disciplines in which they study. Watson noted that the NSF may be least interested in mathematics majors as part of this initiative—the aim is to reach out to other areas. The initiative should not just strengthen a few departments or a few institutions, he noted, but rather should engender widespread change. The "end product" should be students who can utilize mathematical and quantitative skills in whatever they do and who can function effectively in our increasingly technological society. Watson emphasized that proposals must be multidisciplinary and must involve partnerships among faculty in different disciplines. One or two faculty focusing on a small number of courses is not sufficient. There must be a larger interdisciplinary group looking at several different courses or sequences of courses. The focus should be on improving student learning through new courses, new activities in existing courses, new teaching methods, new software, etc.

Watson also noted that strong support from "beyond the departmental level"—meaning from deans and provosts—is likely to be a key factor. In response to a question from the audience, Watson said that he did not mean that one must have a dean as a coprincipal investigator, but rather that launching a large-scale project such as this would naturally need the support of higher administration. In addition, the NSF wants to support projects that do not die out when the NSF funding dries up; unless the institution makes a commitment to the project from the beginning, the project's future can be uncertain. Matching funds from the institution are not required, but, as Watson put it, "it never hurts."

James H. Lightbourne, an NSF program director working on the initiative, said that the NSF hopes to build on successes with earlier reform efforts, such as with calculus,

but that it wants to bring on board more faculty, both from the mathematical sciences and from other disciplines. Planning grant proposals will be limited to five double-spaced pages, he noted; within that space, proposers must set forth a vision of the project, tell which courses will be involved, and describe the interdisciplinary team. He stressed that planning grant proposals should make it clear that interdisciplinary communication has already begun; confining planning within the mathematics department in the hope that other departments will join in later is probably not a winning strategy. Other faculty may join in as the project evolves, but there must be significant cross-departmental communication and collaboration from the outset.

Another NSF program officer working on the initiative, William Haver, noted that although the calculus reform effort has been successful in many ways, it has not really reached a large percentage of students nationwide. The NSF is hoping that, through this initiative, a small number of institutions can attack the larger problems of linking the mathematical sciences and other disciplines to improve mathematical sciences instruction and of bringing about pervasive changes that reach large numbers of students.

One participant from the audience wondered why the NSF was making so few grants of such a large size instead of seeding grassroots efforts through a large number of smaller grants. Haver acknowledged that the mix of large and small grants is a serious question for the NSF; he also noted that DUE will continue to fund smaller projects through its other programs. In addition, Haver pointed out that the initiative will focus on projects that will be useful to institutions all over the nation. Therefore, institutions not receiving these grants could indirectly benefit from the intiative. Tina Straley, another NSF program officer working on the initiative, noted that there is no restriction on the type of institution that can apply for the initiative grants, and coalitions of institutions are especially encouraged. Haver also stressed that the NSF remains committed to supporting calculus renewal efforts. In addition, it is expected that the new initiative will strengthen calulus renewal efforts by supporting some projects which will build upon the success of the calculus program and link the newly developed curricula and approaches to other courses.

Large-scale Projects Require New Thinking

Denice Denton is on the electrical engineering and chemistry faculties at the University of Wisconsin at Madison. She was part of a group that submitted a successful planning grant proposal to CCD for the chemistry initiative. In addition, she has been involved in a couple of large-scale curricular reform projects. Denton said that flexibility is crucial in such projects. There will be a natural ebb and flow—some faculty will join the project early on and later drop out; some will observe at first and join only later. One must be flexible enough to allow the project to evolve and change.

Also, she noted that although $1 million sounds like a lot of money, it really isn't: given the high overhead rates at some institutions, one might be left with around half that amount. She suggested talking to the grants and contracts office at one's university to get a more realistic picture of what one will have to spend. In addition, if n institutions are involved in the project, and the money is divided by n, the funds are stretched yet further. Denton also suggested getting institutional funding commitments in writing.

One needs to get the word out on campus, not only to bring in those who want to participate, but also to get feedback to help guide the project. In preparation for their work on the chemistry initiative, Denton and her colleagues sent out a survey to other departments asking what they expected their students to get out of chemistry courses, what they liked, what they didn't like, etc. The survey form also described the NSF initiative and asked for those interested in participating to contact the project directors. Getting students to contribute their ideas is another important factor.

As for writing up the proposal, Denton noted that many proposals come into DUE without references; she suggested writing these proposals like research proposals, with appropriate supporting references to the literature. She also stressed the importance of the dissemination and evaluation component. Ronald Douglas of the State University of New York at Stony Brook, one of the organizers of the workshop, echoed this point, saying that dissemination and evaluation cannot be add-ons but must be integral parts of the project. Very few mathematical sciences faculty have sufficient expertise in this area, he said, and most will need to bring in someone from outside of mathematics for this component of the project.

Harvey Keynes of the University of Minnesota stressed that, with large-scale projects like the ones the NSF hopes to fund, there has to be a clear mission in mind. "Reform" does not just mean a new textbook and new activities, he noted; it has more to do with looking at the goals of the courses and formulating ways of meeting those goals. In particular, the NSF initiative requires a substantial component for evaluation, and one's goals must be clear in order to evaluate whether or not they have been achieved.

Fostering Collaborations

Keynes mentioned the idea of collaborating with two-year colleges, which also came up in later discussions during the workshop. Many students start out at two-year colleges and transfer to four-year colleges or universities, so it makes sense for the two types of institutions to coordinate the mathematics students learn. One participant in the audience wondered how receptive two-year colleges would be to such collaboration. One of the speakers, Deborah Hughes Hallett of the University of Arizona, responded that, in her experience, it is often the two-year colleges that bring four-year institutions on board when it comes to curricular innovation.

On the subject of collaboration with other institutions, Hughes Hallett noted that her work with calculus reform involved many different institutions, such as Harvard University, the University of Southern Mississippi, and Haverford College. Although involving a large number of institutions can slow down the process of getting started, she said, ultimately the different viewpoints are very helpful, because each institution brings its individual strength into the group.

In addition, dissemination is easier because different kinds of institutions have already tried out the ideas.

Hughes Hallett noted that initiating collaborations with other fields is a difficult challenge for mathematics and one that should be addressed even were it not for the NSF initiative. She had some practical advice for getting started: invite a colleague from another department to lunch. Large meetings with people from different disciplines are often much more difficult, because different groups tend to stake out their own "territories". What is needed, she said, is a good, friendly relationship, not a political alliance. Hughes Hallett also warned against deciding beforehand what to do and then asking other departments to join in. Talking, listening, and looking for common ground will insure that all sides have a vested interest in making the project work.

It almost goes without saying that proposals for the NSF initiative should include something about the impact of the projects on the achievement of groups traditionally underrepresented in science, mathematics, and engineering. Uri Treisman of the University of Texas at Austin described some of his experience in working with underrepresented groups. He noted that it is important to try to build a sense of "community" centered on intellectual interests. In response to questions from the audience, he suggested that if one wanted to improve minority achievement in mathematics, one should "start small" with students who have strong backgrounds and are already interested in mathematics. Once one has "existence proofs", it is much easier to reach out to more students. In addition, he suggested getting mainstream, senior faculty involved in such programs, not just young faculty.

Building on Experience

Although this initiative is a first for the mathematical sciences community (at least at the undergraduate level), the community has built some experience in cross-disciplinary curricular projects. Two of the presentations at the workshop described successful ongoing projects. Frank Giordano and Fletcher Lamkin of the United States Military Academy at West Point described an interdisciplinary mathematical sciences curriculum they have developed, which brings in applications as diverse as pollution along a river, predator-prey problems, and flight strategies for aircraft range. Louis J. Gross of the University of Tennessee at Knoxville described a program he designed to enhance the quantitative skills of students in the life sciences.

Such programs can succeed if the departments involved see improved student learning and understanding as the primary goal. Gross said that he told his colleagues in biology that they are ultimately responsible for what life sciences students learn or do not learn, so biology faculty must also make changes in their own courses if they want to increase their students' quantitative skills. He suggested working with other departments to prioritize what quantitative skills they want to emphasize and to assist them in including a larger quantitative component in their courses.

Some Common Questions

A number of questions about the NSF initiative were posed during the workshop as the participants tried to get a handle on exactly what the initiative was about. Some of the commonly asked questions were:

Question: Can the projects include calculus or precalculus?

Answer: One thing to remember is that the NSF has formulated a vision for this initiative, but ultimately the shape it takes will be determined by the proposals the Foundation receives. The NSF is not ruling out any courses, but the focus must be on a number of courses, not just one or two. The CCD program funds projects for curricular development for individual courses, whereas the initiative is an attempt to stimulate curricular reform in a coordinated way across many courses.

Question: What about nonscience majors?

Answer: Projects should focus on the areas that fall under the NSF's mandate: science and engineering, including social science and economics. Reforming courses like Mathematics for Humanities majors could conceivably be worked into such a project; but again, if that is the sole focus, one would do better to make a proposal to the general CCD program that funds curricular reform for individual courses.

Question: What about equipment?

Answer: Support for equipment is not ruled out, but the projects must be "people-oriented" rather than centered on equipment.

Question: Who will be on the review panel?

Answer: The NSF intends that about half of the review panel be made up of mathematical scientists.

For More Information

E-mail addresses for NSF staff working on this initiative are:

Lloyd Douglas, `ldouglas@nsf.gov`;
Herbert Levitan, `hlevitan@nsf.gov`;
James Lightbourne, `jhlightb@nsf.gov`;
Deborah Lockhart, `dlockhar@nsf.gov`;
Tina Straley, `tstraley@nsf.gov`;
Elizabeth Teles, `eteles@nsf.gov`.

These are Internet addresses; for Bitnet, replace `@nsf.gov` with `@nsf`. The telephone number is 703-306-1669. The mailing address is:

Division of Undergraduate Education, Directorate for Education and Human Resources, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

The program announcement may be found in "Funding Information in the Mathematical Sciences" in this issue of the *Notices*. Copies are also available through STIS, NSF's online information service. For information on how to use STIS, send e-mail to `stis@nsf.gov` (Internet) or `stis@nsf` (Bitnet), or telephone 703-306-0214.

Allyn Jackson

Perspectives on the Underrepresentation of Minorities in Mathematics

An Interview with James C. Turner, Jr.

James C. Turner, Jr., is a professor of mathematics at Ohio State University and at Central State University, a historically black university in Wilberforce, Ohio. In addition to research and teaching, he heads a consortium designed to form educational and institutional research and development linkages among the top research-oriented Historically Black Colleges and Universities (HBCUs) and leading major research universities. A primary goal for the institutions participating in the consortium is a significant increase in the number of minority graduates obtaining Ph.D.s. There has been increasing interest in such issues within the academic community. The following article is an edited version of an interview with Turner, conducted by *Notices* Associate Managing Editor Allyn Jackson.

Notices: *Do you think there is discrimination against minority students who go into mathematics?*

Turner: Yes, there is discrimination. It is not always intentional and certainly not promoted by all or even the majority of mathematicians. Nevertheless, it's there. I've seen it in personal encounters and in stories related to me by minority colleagues and students. I suppose we should not be surprised at this, since the mathematical community is embedded in American society; and certainly there is compelling evidence of prejudices there.

Notices: *What kind of things have you encountered or do your students complain about?*

Turner: Let me put it this way. It's tough to have to constantly bend over backwards to prove that you belong. When you are one of the few minority students in that classroom, the only minority on that faculty, the only one on that important committee, etc., it gets tiresome and counterproductive having to prove that you do belong in this class, you can make a substantial contribution to this committee, you should be a member of this faculty. In my opinion, some of the biggest complaints about discrimination in the mathematics community by minority students and colleagues are linked to this theme. In addition, minorities often carry the added burden that if they fail, then somehow they have failed their entire race, since their failure may mean that there are no minority group members left at all. To me personally this is the hardest part.

The greatest damage done here is to place doubts in the minds of some minority students. Several outstanding mathematicians that I have known have expressed some level of doubt about their contributions to mathematics. To some extent, it is probably natural to have some doubts. However, for many minority students there is an added level of doubt that really shouldn't be there. It affects how much confidence they have in their ability to do mathematics. If you could remove the view that minority students are not capable in mathematics, then you could remove the burden of this added level of doubt.

For many reasons, including those I just mentioned, gifted minority students are attending medical, business, and law schools instead of graduate schools in mathematics. The unfortunate thing is that some of these students actually prefer mathematics. However, to many gifted minority students with several career choices, mathematics is not a good choice. Many view mathematics as having too many roadblocks, an area where they are unwelcome, where there will be limitations. Let me give you an example. I know of a student who came to Hampton University with a very good SAT score and graduated at the top of her class as a math major. She did well in every program she was placed in, including a summer program at Ohio State University. At the conclusion of her studies at Hampton, she told me quite frankly that she preferred mathematics, but from what she had seen of the mathematics profession, she would be better off in another profession. She is now a medical student at Duke University, exploring the possibilities of somehow satisfying her appetite for mathematics.

Notices: *One of the difficulties about going into mathematics is you first have to go and get a Ph.D., and its unclear how long that's going to take. Then you have to get a job, and then you have to get tenure. With medical school or law school, when you get in, you know when you're getting out, and you know you'll have a good job.*

Turner: On the surface it does seem that it is more difficult and that there are more risks involved in pursuing a Ph.D. in mathematics versus getting a medical or law degree. However, there is more beneath the surface. For example, it's certainly not true that everyone getting out of law school will get a "good job". Also, you have to consider the "tunneling factor". I really believe that some gifted minority students

go into medical, business, and law schools because they are "tunneled" into it, in much the same way in which many black male students go into basketball and football. These are proven success areas for blacks. I played basketball in high school and college, and for a long time I really thought that basketball was my best career choice. Luckily, someone showed me another viable choice. Being a minority often means that there are limited choices. We in the mathematical community must make mathematics a viable choice for gifted minority students interested in our discipline.

I might also add that the black community does not view mathematics as a viable choice. Minority students often don't receive crucial support back home if they choose mathematics. Most of the people in my family had no idea of what would be involved in my pursuing a career as a research mathematician. So to them, it seemed not at all wise for someone with some talent to go down a path where clearly very few blacks had been successful. Many told me that law school would definitely be a better choice. These views affect the choices that young people make.

Notices: *People sometimes say blacks just can't do mathematics, but nobody says blacks can't do French literature, for example. Are people affected by those kinds of stereotypes?*

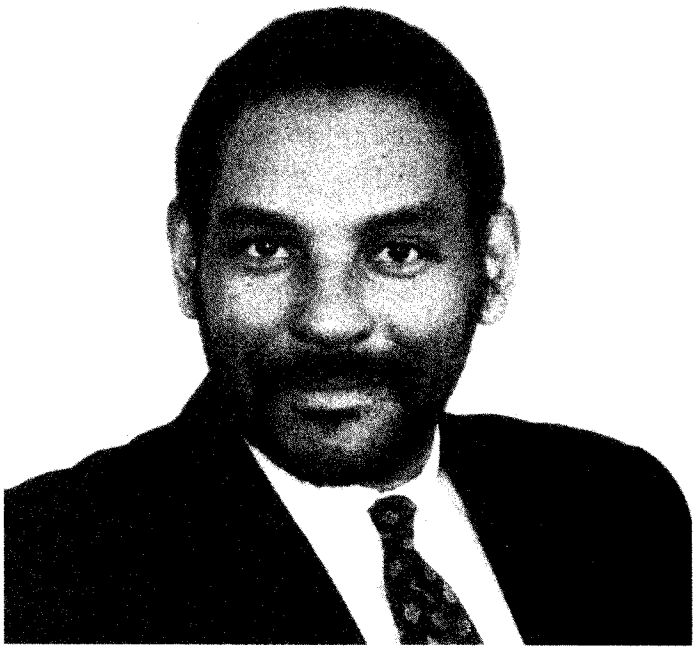
Turner: Absolutely. Unfortunately it's easy for young students to be affected by the truly ugly side of these stereotypes. For instance, the stereotypes may become believable to someone like me who has never taken an undergraduate or graduate course from a black mathematics professor. I have taken all these mathematics courses, from freshman to Ph.D. candidacy, and I have never had a black mathematics professor. It does seem to give support to the stereotype. It's hard not to wonder, "Can we do this?" To a young minority student there seems to be plenty of evidence to support the stereotype. And of course it's our job to show these students that there is even more evidence to disprove the stereotype. I spend a lot of time trying to convince my students that mathematics is hard for everyone. They don't always realize that everybody has to work hard. It's easy for some of them to fall into the trap of believing that it comes much easier for nonblacks. This is one of the ways in which the damage of stereotyping is manifested.

Notices: *So how did you get through?*

Turner: Luckily, I had the good fortune of excellent mentors. At the University of Michigan it was Lamberto Cesari, who worked very closely with me for three years. During this period I also met George Fix, who was the reason I went to Carnegie Mellon for my doctoral studies. Finally, my thesis advisor, Max Gunzburger, played the strongest role in my getting through. These professors made all the difference in the world. There is no doubt that I would not have the Ph.D. if it were not for my association with these mentors. Most minority students are not so lucky. I would really like to see more minority students get this type of mentorship. Mentoring is clearly one of the keys to success.

Notices: *Can white people be good mentors and role models for black students?*

Turner: I certainly do hope so, especially considering that at the Ph.D.-granting institutions, the number of blacks serving as role models is so small. At HBCUs, this issue is probably less controversial. I can't think of any good reason why a good mentor relationship could not develop between any two people regardless of race or sex. On the other hand, there can be a clear advantage in such a relationship if the mentor happens to share many of the student's experiences. For example, a white mentor may not have a clear understanding of educational issues unique to African American students.



James C. Turner, Jr.

Notices: *Can you tell me something about the programs you've been involved in?*

Turner: Before I came to Central State University, I was on the faculty at Hampton University. At that time, the university had just received a large grant to increase the number of minority students attending graduate school in mathematics, science, and engineering. I felt that it was appropriate for me to develop attraction and retention strategies for these students, in particular, strategies that deal with transition points, such as the one between attending Hampton University as an undergraduate and attending institutions such as Ohio State University and Carnegie Mellon for graduate studies. One such strategy was to develop summer programs that ease the transition to the graduate programs at these institutions. In these programs, students attend seminars and colloquia and engage in research projects with mentors from Hampton, Ohio State, and Carnegie Mellon. In this way, minority faculty from HBCUs can form a link with faculty at OSU or CMU to produce good minority Ph.D. students. We have had some level of success, and I attribute that success to the fact that the HBCUs and the major research universities are working together on a problem that both would like to solve. In my opinion it would be very tough to put together a strategy

focusing on this transition point without including both sides of the transition point.

This is one of the activities of the consortium of HBCUs and research universities that I now head. The consortium recognized that these initiatives not only provided students and faculty members from both institutions with exciting opportunities, but they also created a useful model for many other effective minority-oriented initiatives needed throughout the consortium. These initiatives also show that there can be successful, mutually beneficial interaction among members of the consortium.

Notices: *You now have twenty-seven schools in the consortium?*

Turner: Yes—in fact, let me give you a little history. The University Consortium for Research and Development was organized in April 1990 by the presidents of a number of leading colleges and universities. They decided to "break the mold" in terms of addressing the nation's demand for new knowledge, new scientists and engineers, and increased minority participation in research and technology. They concluded that the traditional approaches of targeting schools, programs, and groups needed to be supplemented. Most importantly, they recognized the need for new approaches to interuniversity research in areas of high technology, for expanded knowledge and personnel in critical areas of technology, and for enhanced HBCU research and development activity. They also recognized that such a consortium had never been organized before, but they were convinced that it could succeed, to the direct benefit of the nation.

Within the consortium, a strong partnership developed between the mathematics departments at Hampton University and Ohio State University. As a result of this, I was asked by the Consortium to serve as director and to develop a series of programs that would achieve its goals.

I might add that this consortium is unique in the sense that it is the only one that has the following three characteristics: first, it has mathematics as a main theme; second, it has HBCUs and major research universities working together; and third, it is to my knowledge the only consortium that has a director who is a faculty member at both a historically black university and a major research university.

Notices: *How many underrepresented minority Ph.D.s are there in a given year?*

Turner: Over the years I have never seen this figure higher than twelve. Nowadays there are about 1,100 Ph.D.s in the mathematical sciences awarded each year by American universities. The percentage going to minorities is depressingly low and has not changed significantly over the last two decades.

Notices: *What about at the undergraduate level? How many blacks are there?*

Turner: In 1990-1991, for example, 825 blacks received bachelor's degrees in mathematics. A significant number of these blacks would like to attend graduate school. The undergraduate pool is probably sufficient to dramatically increase the number of minority Ph.D.s.

Notices: *What do you think professional organizations like the AMS and the MAA can do?*

Turner: Well, I know that there is some good work being done by the National Association of Mathematicians in conjunction with the MAA and the AMS. In addition, these organizations should do more in the areas of minority scholarships or research grants, summer research programs, mentoring programs, and travel grants for meetings. Many other societies offer these kinds of support to minorities.

Notices: *I was reading an article about the poor job market in science and mathematics, and it mentioned programs to encourage minority participation in mathematics and science. Some people were asking, are they really doing these students a favor, if there are no jobs? What do you think of that?*

Turner: Every time I hear that, I have mixed feelings. People call me all the time, asking me if I know of any minority students looking for positions. Since there are so few minorities with Ph.D.s in mathematics at HBCUs, for example, there always seems to be a market there. Recently, one chairman at a prominent HBCU told me that he had five positions to fill this year. When I get the call, "Give me a minority candidate," it's difficult for me to deliver. I know the job market is bad. However, I do think it's a different market for minorities. I also hate to see the market being used as an excuse not to produce minority Ph.D.s.

A lot of minority mathematicians, myself included, wonder when the mathematical community will see the issue of underrepresentation of minorities as a front-burner issue. I am really proud of what the mathematics community has done for foreign students. We welcomed them; many of them received their Ph.D.s from American universities, and that's great for mathematics. What we have done for women in mathematics, although the job is not complete, has produced a tremendous turnaround over the situation ten or twenty years ago. That's also great. So the big question is, "When is it our turn?" When will the mathematical community and the major research universities say, "We're just not doing a very good job at the graduate level for minorities; it's time to take this problem seriously?" This hasn't happened yet.

Why Not Try a Sabbatical at the National Security Agency?

Ezra Brown
Virginia Polytechnic Institute & State University

The National Security Agency (NSA) has a mathematical sabbatical program through which mathematicians can spend time working at the NSA on mathematics. The following article provides some information about the program from the viewpoint of one of the participants. For further information about the NSA sabbatical program, contact: Charles F. Osgood, Director, Mathematical Sciences Program, National Security Agency, ATTN: R51A, Ft. George G. Meade, MD 20755-6000; telephone 301-688-0400; e-mail `msp@titan1.math.umbc.edu`.

Got a sabbatical coming up?

Maybe even past due? Like to get away from "the old place" to refresh and invigorate your soul, to find new challenges, to work on that research project you've been putting off, but mainly to spend a year away from "them"? And you have no particular university in mind?

I can sympathize—that's where I was five years ago. I knew I could keep a secret, so I started thinking about applying for the National Security Agency's Mathematical Sabbatical Program.

I knew of the NSA through their recruiting visits to our department and university; for years they had hired our mathematics graduates at both bachelor's and master's levels. The recruiters were often our own former students who would say, "Wonderful stuff, but I really can't tell you" when I'd ask them what their jobs involved. I was frankly quite curious about the "supersecret" outfit they worked for.

It was not until 1989 that I began thinking seriously about spending a sabbatical year at the NSA. That fall the recruiter was David Lijewski, who had taken abstract algebra from me some years earlier. He told me about their sabbatical program, but at the time of his visit I was more interested in getting him to meet with some of our students than in looking into my own prospects. Some months later I had a conversation with a colleague at another university who had once worked for the NSA and who continued to consult for them. His enthusiasm about the people who worked at "The Fort"—as the headquarters of the NSA at Ft. Meade, MD, is known—and about the working environment there was infectious. In a word, I was hooked.

So I fired off a letter to David requesting specific information about the NSA's Mathematical Sabbatical Program. A few weeks later, a packet arrived in the mail, accompanied by a short note from David encouraging me to apply. So I did.

Some Specifics about the Program

A few specifics about this program: the term of the sabbatical is anywhere from nine to twenty-four months—that's negotiable. It's your standard half-and-half program in that your university and the NSA each pay half your salary, but the NSA pays the university first, so you don't notice any change in your paycheck. They will also pay you a certain amount per month—it works out as reimbursal of rent—to help with your living expenses. All in all, it worked out very nicely.

But, you may ask, what about all the usual hassles of going on sabbatical (living arrangements, schools for the young'uns, renting out the old homestead, the two-body job problem)? What are the working conditions like? Does the NSA expect a 40-hour week? Are you tied to a desk? And by the way, what if your research area is not applied?

And what about all those application forms and the security clearance and the polygraph test? Can you publish your research? What's in it for your home university? What about the people you work with? And finally, what about all that secrecy?

First of all, any sabbatical leave is going to involve some of the hassles you mentioned. Comparing notes with folks about difficulties involved with your standard sabbaticals at other universities, I'd say it's a wash. (The best deal is to engineer an exchange with someone at another university, an option not available with the NSA. But I'm working on that.) Job opportunities for spouses might be more plentiful in the Greater DC/Baltimore area than in university communities or not, depending on where you look. Certainly housing is available, although it is not cheap to live in that area. As for schools, I'm no expert: all of our kids were in college or graduate school during the sabbatical.

Fascinating Research Problems

When I went for my final briefing (physical, polygraph, and a few other items), representatives of several different divisions met with me and gave me a somewhat edited version of what goes on in their shops. Based on their interests and my interests, I picked a particular division—the rough

NSA equivalent of a department—whose problems seemed intriguing.

It turned out to be an excellent choice for me. I was given a desk and a workstation, briefed on several problems, and then I fell to. The desks had no chains; and although I kept track of hours worked, I was not required to do so—no time card, although the regulars there do have time cards. I also had the opportunity to work closely with folks in other divisions on a regular basis. In principle, half the time you work on agency problems and half the time you work on your own research. For me, the agency problems were so fascinating that I worked on them during the day and my own research in the evenings. You can work most of this out informally with your division chief.

This brings up a point.

Are you one of those dedicated folks who always takes work home? Well, guess what? You can't do that at the NSA—a perfect way to keep your own research separate from agency research!

Speaking of your research area: I met mathematicians at the NSA whose Ph.D.s were in geometry, combinatorics, commutative algebra, topology, real analysis, algebraic topology, algebraic geometry, noncommutative group theory, field theory and complex analysis, as well as my own area of number theory. You may recall that number theory was praised by G. H. Hardy for its great beauty, purity, and uselessness. Hah! The point is that mathematics is a core discipline at the NSA; all I'll add to that is that my sabbatical totally changed my idea about what is and is not applied mathematics.

Here's one more thought on research. If you are just finishing up a research project but you haven't quite gotten geared up for a new one, it's a perfect time to go off to the NSA. Some of the unclassified research going on there might be just where your interests lie.

What about Bureaucratic Hassles?

But what about the application process and that lie-detector test and other bureaucratic hassles?

No one likes filling out who-knows-how-many forms and signing every other page, but for me, it was worth the effort. True, the NSA is a bureaucracy—how's *your* university on that score, by the way?—so keep copies of what you send in, and bug them mightily if it appears that nothing is happening. Finally, I didn't think the polygraph test was that stressful. Mostly they want to know, in the words of Dick Francis, if you can be "blackmailed, bribed, or bullied into telling". The worst part was not knowing beforehand what it's like.

On publishing your work, there's both good and bad news. The bad news is that if it's classified research, you can't publish it. The good news is that a number of NSA folks also work on unclassified current research topics; such work can be, and is, published and discussed at professional meetings. For example, at the Joint Mathematics Meetings in January 1992 in Baltimore, John Dillon of the NSA organized an AMS Special Session on Designs and Codes; about a dozen NSA folks gave talks at that session and at four other sessions.

As for the advantages to your home university, they are many and varied. You will acquire new skills and sharpen old ones; you will return with fresh enthusiasm and a new perspective relative to the issues with which your department has been grappling for years; your students will hear about the NSA as a potential employer; you will learn about new grant opportunities. Mention these, and your department head or chair will be much more supportive of your sabbatical application.

Terrific Colleagues

Finally, what about the people there?

My colleagues were terrific. Let me embarrass them and name a few: Rob Campbell, Becker Drane, Ellen Rabe, Mike McGlynn, Dean McCullough (who never met a FORTRAN program he didn't like), Dick Shaker (chief of the Mathematical Research Division at the NSA and the man for whom the word "enthusiasm" was invented), and especially my division chief, Mike Chernesky. They couldn't have been nicer and more pleasant to work with. If I needed information on a problem or help with a program, there were always plenty of knowledgeable folks who were more than willing to give help, advice, or encouragement.

I had a wonderful time and came back to the Ivory Tower renewed and invigorated. This can also happen to you: to quote the old commercial, "Try it—you'll like it!"

Forum

The Forum section publishes short articles on issues that are of interest to the mathematical community. Articles should be between 1,000 and 2,500 words long. Readers are invited to submit articles for possible inclusion in Forum to:

Notices Forum Editor
American Mathematical Society
P.O. Box 6248
Providence, RI 02940

or electronically to `notices@math.ams.org`

Probably True Theorems, Cry Wolf?

László Babai
University of Chicago

"The wolves are in our midst," warns Steven G. Krantz in his passionate critique[1] of John Horgan's misguided opus "The Death of Proof", *Scientific American*, October 1993.

There is a need to clarify the notion of *probably true mathematical statements*, featured prominently, and generally misinterpreted, in Krantz's rebuttal.

The classic examples of probably true statements come from probabilistic tests of primality such as the Solovay-Strassen test, which is based on the following result.[2]

Let $n > 1$ be an odd integer. Call an integer w a Solovay-Strassen *witness* (of compositeness of n) if $1 \leq w \leq n-1$ and either g.c.d.$(w, n) > 1$ or $w^{(n-1)/2} \not\equiv \left(\frac{w}{n}\right) \pmod{n}$, where $\left(\frac{w}{n}\right)$ is the Jacobi symbol (computed via quadratic reciprocity as easily as g.c.d's are computed via Euclid's algorithm). Note that no S-S witness exists if n is prime. On the other hand (this is the theorem), if n is composite, then *at least half* of the integers $1, 2, \ldots, n-1$ are S-S witnesses.

Suppose now that we want to decide whether or not a given odd 200-digit integer n is prime. Pick k integers $w_1, \ldots, w_k$ independently at random from $\{1, 2, \ldots, n-1\}$. If any one of the w_i turns out to be a witness, we know that n is composite. If none of them are, let us conclude that n is prime. Here we may err, but for any n, the probability that we draw the wrong conclusion is at most $\varepsilon = 2^{-k}$. Setting $k = 500$ is perfectly realistic, so we shall have proven the mathematical statement "n is prime" beyond the shade of doubt. Yet, we won't have a formal proof.

Viewed another way, the S-S test can be regarded as sampling lines from an extremely long, $(n-1)$-line ($n \approx 10^{200}$) *formal* proof of primality of n. Line number w consists of the calculation verifying that w is not a witness. Normally, in order to *verify* a formal proof, one needs to check every single symbol: a $\geq$ sign where only $>$ is correct can invalidate the entire proof. This particular formal proof of primality is much more robust: if we are willing to give up the absolute certainty mathematics is believed to guarantee and content ourselves with a verification beyond the shade of doubt (say, $\varepsilon = 2^{-500}$), it suffices to check a fixed number of randomly selected rows. (Five hundred rows suffice in the example, as opposed to the 10^{200} rows required to be checked for complete certainty.) Such probabilistically checkable proofs are (informally) called *transparent* or *holographic*.

The recent news is that *every* formal mathematical proof (in ZF, say) can be transformed into transparent form.[3] If the little green folks come and claim they have a formal proof of the Twin Primes Conjecture (TPC) which is too long for us to read, we just have to ask them kindly to rewrite the proof in transparent form on a few million tons of CD-ROM's. Then, by making a few spot checks to the transformed proof, we shall be almost sure that indeed there are infinitely many twin primes. This near-certainty will be precisely quantified; the probability that we accept their proof while TPC is false or independent of ZF will be less than 2^{-ck} where k is the number of spot checks and the constant $c > 0$ is provided by the theory. This theory is pure mathematics, replete with proofs that Euclid, Hilbert, or Krantz could appreciate.

There are philosophical concerns over the feasibility of generating independent random numbers. "Almost certain proofs" of the Solovay-Strassen variety may amplify the

[1] S. G. Krantz, *The immortality of proof*, Notices Amer. Math. Soc. **41** (1994), 10–13.

[2] R. Solovay, V. Strassen, *A fast Monte-Carlo test for primality*, SIAM J. Comput. **6** (1977), 84–85.

[3] Cf. L. Babai, *Transparent proofs* and *Combinatorial optimization is hard*, MAA Focus, June and September 1992, for a popular account. For technical surveys, see D. S. Johnson, *The NP-completeness column*, J. Algorithms **13** (1992), 256–278; and L. Babai, *Transparent proofs and limits to approximation*, Proc. First European Congr. of Math., Birkhäuser (to appear).

significance of these concerns. But such worries apart, a S-S proof of primality seems to provide rock-hard evidence, and so does a transparent proof after successful spot checks.

"Almost certain proofs" differ fundamentally from experimental mathematics.[4] The latter uses physical or computer experiments to gain insight or illustrate results. While "almost certain proofs" may not provide either insight or illustration, they *prove* mathematical statements.

[4]Krantz blurs this distinction by repeatedly juxtaposing "probable proofs" and "graphic analysis" (observation of computer graphic pictures). Borrowing a phrase Krantz applies to Horgan, we can't help but note that Krantz himself is using "a classical propagandistic technique" here.

Are such proofs going to be the way of the future? Hardly, at least not in the mathematics we enjoy.

Do such proofs have a place in mathematics? Are we even allowed to call them *proofs?* We leave the reader to ponder these questions.

A final note to Steve Krantz. While addressing, as we should, the menace of hardware-centric bureaucracies, the oxymoron in proof-free Euclidean geometry, and the potential of Horgan's ideology to become a weapon against intellectual pursuit, let us not confuse our faithful friends with the wolves.

Acknowledgment. I wish to thank Gene Luks and Peter May for their comments on previous versions of this letter.

Computers and Mathematics

Edited by Keith Devlin

This month's column

The design and implementation of software for use in education or research is a difficult task. Just as authors of technical books lay themselves open for attack when readers and reviewers notice errors, so too those involved in the preparation of software packages run the risk of having their mistakes laid bare for all to observe. Fortunately, there has never been a shortage of either writers of books or developers of software, brave souls prepared to run the gauntlet of their colleagues.

This column does not generally publish reviews of software that, in the reviewer's opinion, have so many flaws—or a single major flaw—that the package is of little or no use. The only exception to this policy is where the software has been published commercially. In all cases, reviewers are asked to mention any bugs they find when trying out the software. Bugs that cause the program to freeze or the system to crash are annoying, but at least on those occasions the user *knows* there is a problem. Far more worrying are bugs that do not cause a program crash, and indeed do not lead to any apparent incorrect behavior, but can lead to an erroneous result. The first of the three reviews that make up this month's column reports on just such a bug. This is John Nolan's review of *IMAGE-Calculus*. In the reviewer's opinion, the bug in question is sufficiently dangerous to render the program inappropriate for the educational use for which it is designed.

These are relatively early days in the development of mathematical software—indeed software of any kind—and mistakes are inevitable. With the assistance of its reviewers, this column tries to contribute to the development of better software. In the meantime, let the user beware!

The second review published this month, Mihai Cipu's review of *Mathematical MacTutor*, also includes mention of bugs, though these do not appear to be as "dangerous".

Finally, Frank Zizza reports on his experiences with the package *Mathematica Help Stack*.

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Reviews of Mathematical Software

IMAGE-Calculus

Reviewed by John P. Nolan*

IMAGE-Calculus is a program written to illustrate the basic ideas of calculus. After entering a function, one can graph it, draw tangents, numerically evaluate limits, symbolically differentiate, and numerically integrate to find area, arc length, surface area, and volume of revolution. The program was developed by Christopher D'Arcy at St. Georges College, and it is sold by Brooks/Cole Publishing Company for $43.25. The IBM PC version of the program was tested; apparently the Macintosh version is no longer available.

The IBM PC version requires minimal hardware: 256K memory, CGA or CGA-compatible monitor, DOS 2.0 or higher, and a floppy drive. *IMAGE-Calculus* is small (the program and data files use less than 300K), easy to run, and not picky about hardware. It ran on everything from an old PS/2 30, to a laptop, to a high performance 486, with and without math coprocessors, with various monitors.

IMAGE-Calculus is organized into four categories: concepts, fractals, utilities, and calculator mode. The menus for these categories are associated with the first four function keys: F1 for concepts, F2 for fractals, etc. Pressing the function key shows the menu of options. Unfortunately, one cannot use the cursor keys to select from the current menu, you must use key combinations to select: Alt-F to enter a function, Alt-G for graphing, Alt-L to evaluate limits, etc. As you can see, most of the keys are coded alphabetically, but it is still annoying to have to learn these codes initially. The manual walks through each option with an example; it is adequate for general use. The manual is sparse on technical details—it mentions that one can use a mouse to select off a

*John Nolan is an associate professor at American University in Washington, DC. He has taught at the University of Zambia, Kenyon College, and the University of North Florida and has developed clinical computer systems in a private software company. His research interests are in probability theory.

menu but gives no directions. I could not get the mouse to work. A phone call to the support line at the publisher was pleasant but did not resolve this or other problems; questions and complaints would be forwarded to the developer.

Most of the calculus ideas are in the concepts category. The first thing one generally does is enter a function and an xy-region that will be used with the graph. The first and second derivative are calculated symbolically and show up below the function. The equation parser has some bugs. Certain errors are detected and an inconspicuous one-line message appears at the bottom of the screen; a pop-up window or an audible beep would make such user errors more noticeable. The one serious bug I found in *IMAGE-Calculus* is that it does not always detect ill-formed formulas. For example, `x^2+5x+3`, which is missing a '*' in the second term, gets truncated and is treated as `x^2+5` with no error message given. This caused me considerable confusion while looking at related graphs and derivatives. *IMAGE-Calculus* prints the original (ill-formed) formula on the graph of the truncated formula, so in the above example `x^2+5x+3` has a y-intercept of 5. Also, the program only works with integer powers, though the parser will accept formulas with fractional powers and proceed to make up bizarre rules for differentiating and graphing them.

Once a function is entered, it can be graphed on a new axis or superimposed on the previous graph. After the plot is drawn, one can zoom in on a region (but not out) or find the roots (presumably numerically). One can also plot f' and f'', either separately or superimposed. Changing the bounds on the graph is awkward: one has to leave the graph section, go back to the function definition section, change the bounds, and then start the graph again. The tangent command draws tangents at a specified point and shows the equation of the linear approximation. Multiple tangents can be drawn. See Figure 1 for a sample of a graph with tangents drawn.

The nicest command in *IMAGE-Calculus* is Analysis. This automatically generates a table of significant points of the function: it finds places where f, f', and f'' are zero (the derivatives are calculated symbolically; the zeros are apparently found numerically), and a list is shown with an English phrase describing what happens at each point. See Figure 2 for a sample output. This feature is quite handy for analyzing a graph and shows how much of what is taught in a traditional calculus I class is mechanical.

The Definite Integral option numerically integrates to find areas and arc length, as well as surface area and volume of revolution. Each operation requires bounds and the number of partition points to use. The output is a numeric answer and a graph of the quantity being calculated. The perspective on the surface of revolution is odd. Also, more range checking should be done—you can crash the program with some fiddling of the bounds of integration.

The Limit part of the program numerically approximates limits from the left and from the right. You are prompted for a value $x = a$ and the current function is evaluated at $a \pm 2^{-n}, n = 1, \ldots, 8$; no control is given over the spacing. The routine for Newton's Method asks for a starting point, then shows the first four Newton's approximations to the root along with a graph. No option is given for more iterations. The

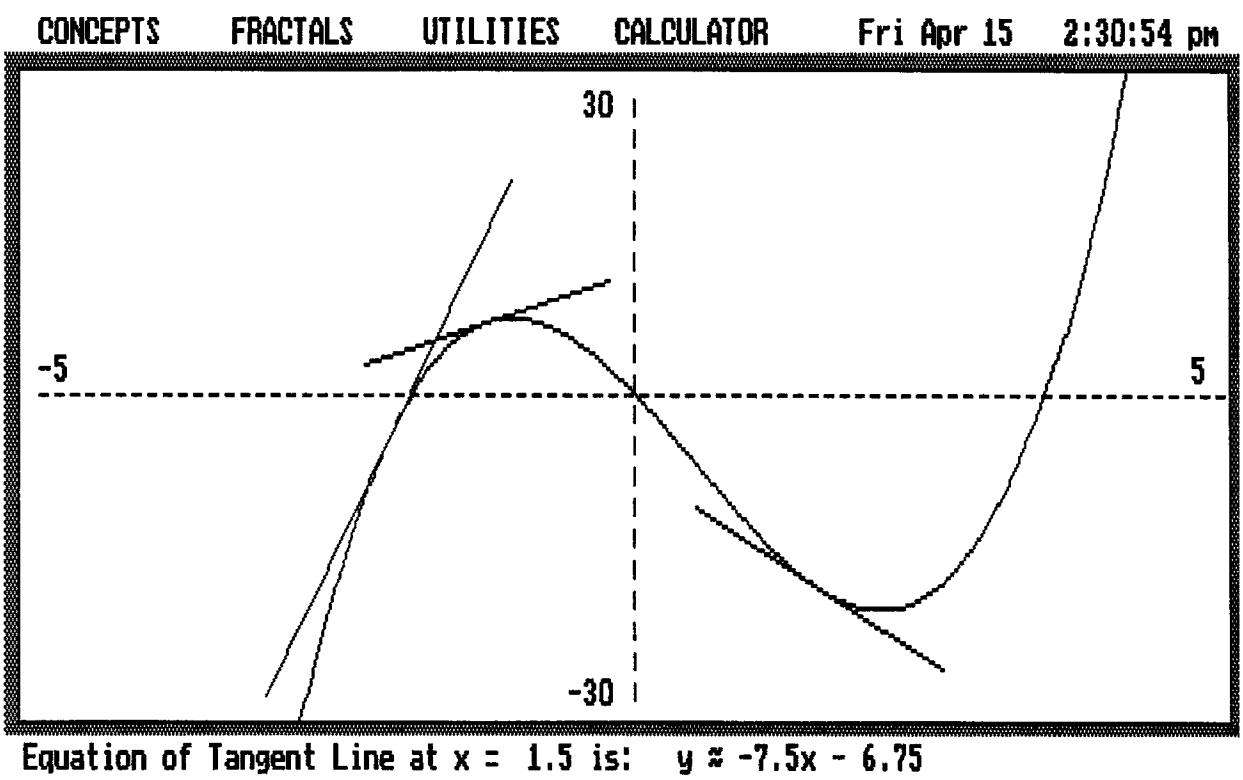

Figure 1: IMAGE-Calculus graph of $2x^3 - 3x^2 - 12x$ with tangents.

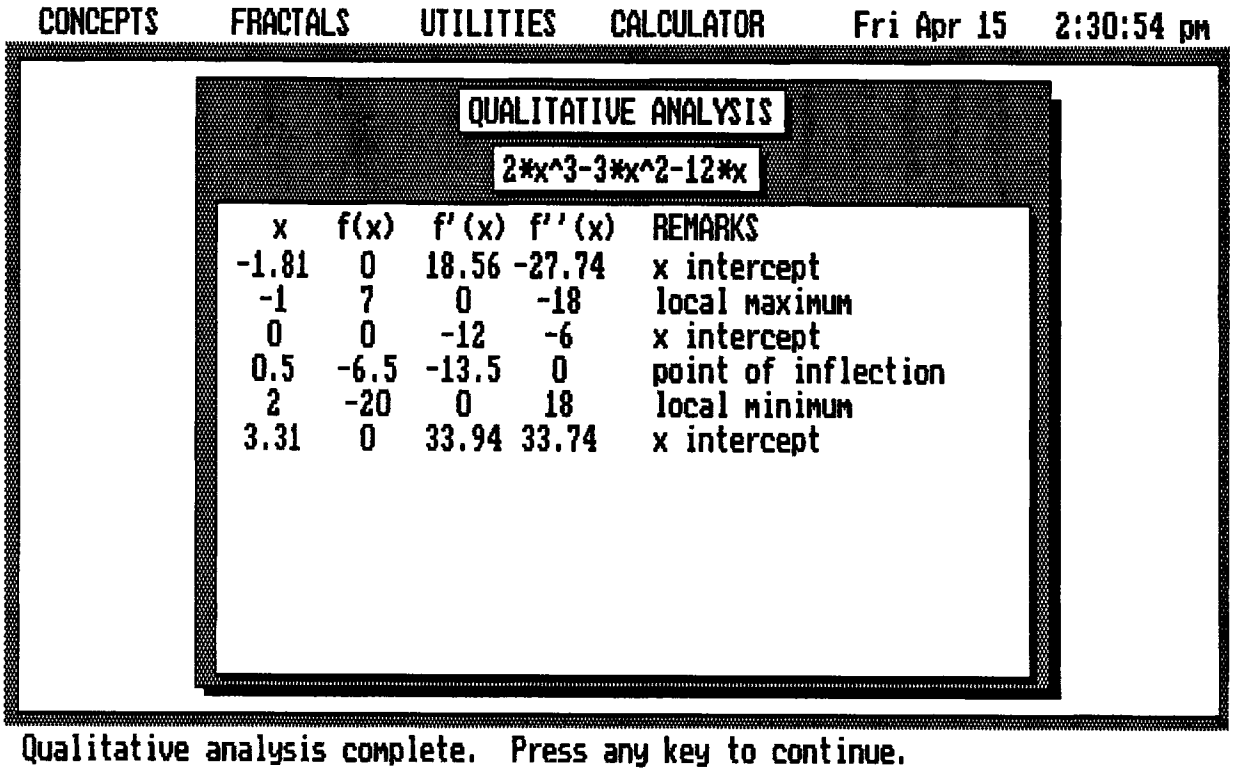

Figure 2: Analysis of $2x^3 - 3x^2 - 12x$ showing roots, critical points and inflection points.

Exponential Growth choice explores the exponential function $A(t) = A(0)\exp(kt)$. The user is prompted for $A(0), t_1$, and $A(t_1)$; the program calculates k, shows the equation, and plots the exponential curve. The Maclaurin Approximation option calculates symbolically the first four terms of the power series for $f(x)$ at $x = 0$ and superimposes their graphs. No control is given over the point around which the expansion is given, nor can one get more terms. The Parametric Curve section lets you give a pair of functions $(x(t), y(t))$ and a range for t, and the curve is plotted. Awkwardly, the bounds for the graph are the ones last entered in the function definition window and generally have nothing to do with the current parametric equations. The Polar Graph routine is similar. Both sections have several sample functions builtin, a nice feature to start students exploring. This feature could be useful in other parts of the program.

The Fractal menu lets you view the Mandelbrot set, an associated Julia set, or a graph of period doubling. These fractal routines seem like an afterthought, with little connection to the rest of the program and no explained connection to calculus. The Utilities menu provides several useful features: clear the screen, save the screen to a file, load a screen image from a file, print, etc. The final menu is a scientific calculator. In addition to standard calculations, the current function and its first two derivatives are available for point evaluations.

A brief comment on two things I would like in a general calculus program: First, the ability to specify a function piecewise with some kind of case statement would eliminate unnecessarily complicated linear combinations of shifts and scales of step functions. Second, while I understand the programming difficulties, the automatic distinction this and other programs make between symbolic differentiation and numerical integration seems artificial to me. An ideal program would be able to integrate reasonable functions symbolically. When it cannot find an antiderivative, it could say so and ask the user if a numerical approximation is desired.

I have used *MicroCalc* and *Mathematica* for research and teaching purposes for five years, and I have experimented with *True Basic Calculus*, *Maple*, *MPP* (Mathematics Plotting Programs, developed at the U. S. Naval Academy), and University of Arizona mathematics software. Here is a personal telegraphic comparison: I would group *IMAGE-Calculus* and *True Basic Calculus* together as simple programs that do standard calculus operations. *MicroCalc* is also easy to use, has more options, and is cheap. *MPP* and the University of Arizona software are both free and a little less user-friendly. The Arizona software has the nice ability to graph and work with data sets as well as standard functions. *Maple* and *Mathematica* are much more powerful; both are harder to learn; the student edition of the first costs about twice as much; the second is an order of magnitude more than *IMAGE-Calculus*.

The features I like in *IMAGE-Calculus* are its ease of use, small size, the unique Analysis option that locates and classifies important features of a function, and that sample functions are built in for demonstration purposes in some parts of the program. Overall I find the program useful, but I would be hesitant to use it in a class because of the bugs and limitations mentioned above.

Mathematical MacTutor

Reviewed by Mihai Cipu*

Purpose

A computer-based enhancement of the teaching of mathematics.

Authors

The system was created by Graeme E. Bell, John J. O'Connor, and Edmund F. Robertson, University of St. Andrews, Fife KY16 9SS, Scotland; e-mail: `efr@st-andrews.ac.uk`. Applelink AITON.JF

General Features

Mathematical MacTutor is a large program, aiming to supplement the traditional modes of teaching a very wide range of mathematics. Its objective is simply stated: conduct mathematical experiments with the burdens of heavy calculation and formal analysis removed. This simple idea is difficult and time consuming. The authors have taken upon themselves the painful task of designing and developing a simple user interface for powerful tools in the exploration of mathematics. Students have at their fingertips calculating and graphical facilities for investigating various concepts, results, and demonstrations. They also have access to historical information about how the subjects developed.

The system was developed using the Apple Macintosh application HyperCard, extended by specially written Pascal routines. This consists of over 150 different stacks, amounting to about 2,000 separate cards. *MacTutor* is operated in the familiar point-and-click fashion. Each of the stacks has a `Home` button. Clicking this takes one back along the route used to reach the stack. Other buttons allow sequential movement to the cards of each stack. It is possible to use different routes to reach any card. Each stack has a `Cross reference` button which allows the user to move directly to other stacks covering the same area of mathematics.

No knowledge of programming is required. Indeed the Introduction to the Mac stack from the **Miscellaneous** package gives some details of the Macintosh and how to use HyperCard. There is also a stack named Tips which offers assistance with how to use the *MacTutor* system. Moreover, almost every card has its own `Instructions` button giving genuinely helpful messages. The authors make provisions for likely mistakes; the tutor has the possibility to disable some of the keyboard commands so that students do not have access to all the facilities of HyperCard and cannot damage the software. All the stacks have been protected, so when you leave any stack, it is left the same as when you first entered it.

Contents

The main areas covered by *MacTutor* correspond to the following twelve packages: **Algebra, Calculus, Calculus Quizzes, Complex Analysis, Elementary Quizzes, Geometry, Graph Theory, Matrices/Vectors, Miscellaneous, Number Theory, Other Topics, Statistics**.

A large part of the teaching material was conceived in such a way that the user is challenged to discover concepts, statements, patterns, and explanations by experimenting with thoughtfully selected examples. Along with the preset examples, students will have to settle random problems generated by the Mac. Several stacks look at some important examples of groups of symmetries of plane figures. One encounters permutation groups and two-dimensional crystallographic groups. Some stacks provide a calculator to do modular arithmetic or calculations in small fields. One can use a multiple-precision package to handle numbers up to 255 decimal digits. There are sections including all the facilities for graphing functions, investigating zeros or continuity, and the Fourier analysis of functions. One may specify a system of differential equations and solve it numerically. A stack allows integration around any curve and may be used to verify Cauchy's theorem. There are animated displays of the following: eleven basic results about the geometry of the triangle, different methods of tiling the plane, the effect of applying a transformation to the plane, two probability models for the process of oil percolating through a porous material, and how to calculate the mean and variance of a sample by using group frequency tables.

Besides this category of stacks that one would expect to find in a mathematical package, *MacTutor* contains a large number of questions, exercises, and tests covering all the above-mentioned areas. Sometimes one is asked to answer true or false, while other times one is faced with multiple choice tutorials. In each case, a full explanation of the right answer is given. There is a set of more unusual questions about mathematics and mathematicians, aiming to present a broader perspective.

There is also a collection of (slightly) famous games and puzzles. Letting students play with the Mac reinforces the mathematical theory behind the games. One encounters challenges of various degrees of difficulty—but challenges that can be met.

Comments

Installing *MacTutor* went smoothly. The procedure is simple and accurately described in the documentation. In fact, the entire program is easy to use, and I enjoyed playing with it.

All the procedures were exercised several times. From the mathematical point of view, there are no major bugs; however, I have noticed some inaccuracies which might fall into the category of typos. For instance, in the **Calculus** package, Continuity stack, Question 7, there is a function defined for $-1 < x < 1$ by the formula $y = \text{abs}(x)/x$. In the same stack,

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Question 9 refers to the function $\log(x-1)+1$ for $0 < x < \frac{1}{2}$. In the Higher Quiz stack in several places I would prefer mentioned explicitly that the basis of the logarithmic function is a positive real number other than one. Additionally, the statement of Fermat's Problem from the **Geometry** package must refer to the sum of the distances to the vertices of the given triangle.

At the programming level, I found more that the authors had overlooked. In the "Twin primes" card, the `Primes with` $(p+1)/2$ `prime` button backtracks to 9973 when started at 10,000 (similar behavior was noticed with the `Primes with` $(p-1)/2$ `prime` button). In the **Elementary Quizzes** package Higher Quiz stack, Question 1, the drawn line does not contain the correct origin, judging from the answer given. Much more serious is that the program does not validate the input. Thus, the input $\sqrt{-169}$ to the Continued Fractions stack leads to infinite cycling. The Factorizing Big Numbers card gives, for instance, $0 = 1$, $-2 = 2$, $r = 1$, $98 - 9 = 989$. Also, the More Factorization card returns $-09 = 3^2$, and after that the computer freezes and must be shut down. The most frustrating experience I had was with the Famous Curves stack. About one-third of the cards do not work properly.

From the pedagogical point of view, there is only good news. The user is efficiently guided through the system, with any difficulties solved by adequate hints. With ease and pleasure, students gain insight into and knowledge of different areas of mathematics. There are, of course, debatable items (e.g., why give details on Abel in the Inequalities stack?). Surprisingly I found Morley's Theorem attributed to Napoleon.

There is an enormous functionality with the teaching material (much of which I have not mentioned). Among the most remarkable stacks are Tesselations, Conformal Mappings, Automata, Simulations, Polynomials, and Trivia (no joke!). A very useful feature is the ability to return a partial factorization of large numbers. When playing games, *MacTutor* will let one undo moves and replay partial solutions. The system shows solutions to several of the games. It also creates attractive graphics. A point I wish to emphasize is that *MacTutor* attempts to place mathematics in a broader cultural context.

Though the authors do not mention how old *MacTutor* is, there are at least three signs of its age: 1) it mentions Prague, Czechoslovakia; 2) it is mentioned that Euler died in Leningrad (nowadays it is again called St. Petersburg); and 3) the authors claim that many local authorities in Scotland have purchased *MacTutor* (this confession is an indubitable clue of the success *MacTutor* has). On the other hand, it is clear that the authors keep track of the latest developments in mathematics and continue updating *MacTutor*. The July 1993 version of the program includes a mention of Andrew Wiles' proof of Fermat's Last Theorem.

Conclusions

Rather than being a replacement for the conventional modes of teaching, *MacTutor* is a nice complement. It is a well-designed program which does what it says. I think that the software can be successfully used in high schools and universities. Powerful and versatile, easy to use, *MacTutor* permits users to go further faster by experimenting in mathematics. Debugging and correcting the errors will result in a polished form of what might be the ultimate tutor program in mathematics.

Required Facilities

To install the whole of *MacTutor*, one needs almost 12 Mb of free space. The version using HyperCard II requires at least System 6.0.5. Some of the tutorials give access to a calculator. This feature will not work until the user has added the appropriate desk accessory to the system. There are separate versions of *MacTutor* for small screens (i.e., 9-inch or 12-inch low resolution) and for machines with large monitors (i.e., 13-inch or bigger). Having a color monitor is not compulsory; however, many cards take advantage of such equipment.

An application is provided with the system for printing and saving all or part of the screen.

Availability

The *Mathematical MacTutor* system is available for £250 ($400) from the authors. A campuswide site license can be bought for a further £550.

Mathematica Help Stack

Reviewed by Frank Zizza*

Mathematica Help Stack is a Hypercard stack for Macintosh computers that is essentially an on-line reference manual for the *Mathematica* computer algebra system. Its strengths are its simplicity and its hypertext features. The current version of the *Help Stack* is for *Mathematica* version 1.2, but the current version of *Mathematica* is 2.2. There are some significant differences between the two versions of *Mathematica*, but *Help Stack* remains a useful tool for novice and intermediate users of *Mathematica*.

Requirements for *Mathematica Help Stack* are a Macintosh computer with Hypercard or HyperDA. Installation of *Help Stack* requires 4 MB of space on the hard disk; and when running, Hypercard and *Help Stack* require approximately 1 MB RAM. If you also want to run the *Mathematica* kernel at the same time on the same Mac, an additional 4 MB RAM are required.

Anyone familiar with a Mac will have no problem installing and using *Help Stack*. Not having used the Hypercard program previously, I had *Help Stack* installed and operating within five minutes of opening the shrink wrap.

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Upon starting *Help Stack*, one is presented with the "Map". The Map (Figure 1) separates into logical groups the approximately 700 built-in functions of *Mathematica* and presents these groups in an array that is used to navigate to the information for each individual *Mathematica* function. This organization of functions is well thought out and is a very helpful tool for locating a function's information quickly.

For example, suppose someone wanted to graph the real part of the complex function $e^{(1/z)}$ near its essential singularity. Starting from the Map, one would click the icon for Graphics 3-Dim. One is then presented with a panel that presents all of the *Mathematica* functions categorized under Graphics 3-Dim (Figure 2).

The hypertext feature now allows one to click on the word `Plot3D` to bring up the information panel for `Plot3D` (Figure 3).

The panel contains a central field with usage information for the `Plot3D` command. Above the central field is a summary of the syntax for the command. To the right of the central field are three buttons labeled Details, Notes, and Examples. Clicking on Details brings up a panel that shows the *Mathematica* options and attributes for the `Plot3D` command and the default setting for these options. The options are hypertext-linked to their panel, so one can quickly retrieve the information for each option. The Note button brings up an empty clipboard for the user to save personal examples and notes. The Examples button brings up a panel that contains several examples of the `Plot3D` command, including examples with useful options set. Below the main field are buttons to step back in the hierarchy of the Map.

From the information in the `Plot3D` panel, one deduces that the correct *Mathematica* command for our essential singularity graph is `Plot3D[Re[E^(1/(x + I y))], {x, -0.1, 0.3}, {y, -0.1, 0.1}]`. This command produces a rather bland picture (Figure 4 on page 462).

Having seen this plot, we might consider increasing the number of points plotted to resolve some detail near the essential singularity. In the `Plot3D` panel under Detail, one finds the option `PlotPoints`, and clicking on the word brings us to its panel (Figure 5 on page 462).

We see the command to *Mathematica* should change to `Plot3D[ Re[ E^(1/(x + I y)) ], {x, -0.1,0.3}, {y, -0.1, 0.1}], PlotPoints -> 100]` which produces a much more interesting picture (Figure 6 on page 463).

The usage information in the panel for `Plot3D` is a combination of the information found in the *Mathematica* book [1] and some additional information. The advantage over the *Mathematica* book is that all related functions are listed together, and the hypertext feature allows for rapid browsing of these related functions and options by simple mouse clicking. Other nice features include an alphabetical hypertext index of all the cards and all the bells and whistles built into Hypercard. Each function's panel also references the page(s) in the first edition of the *Mathematica* book where the function is discussed.

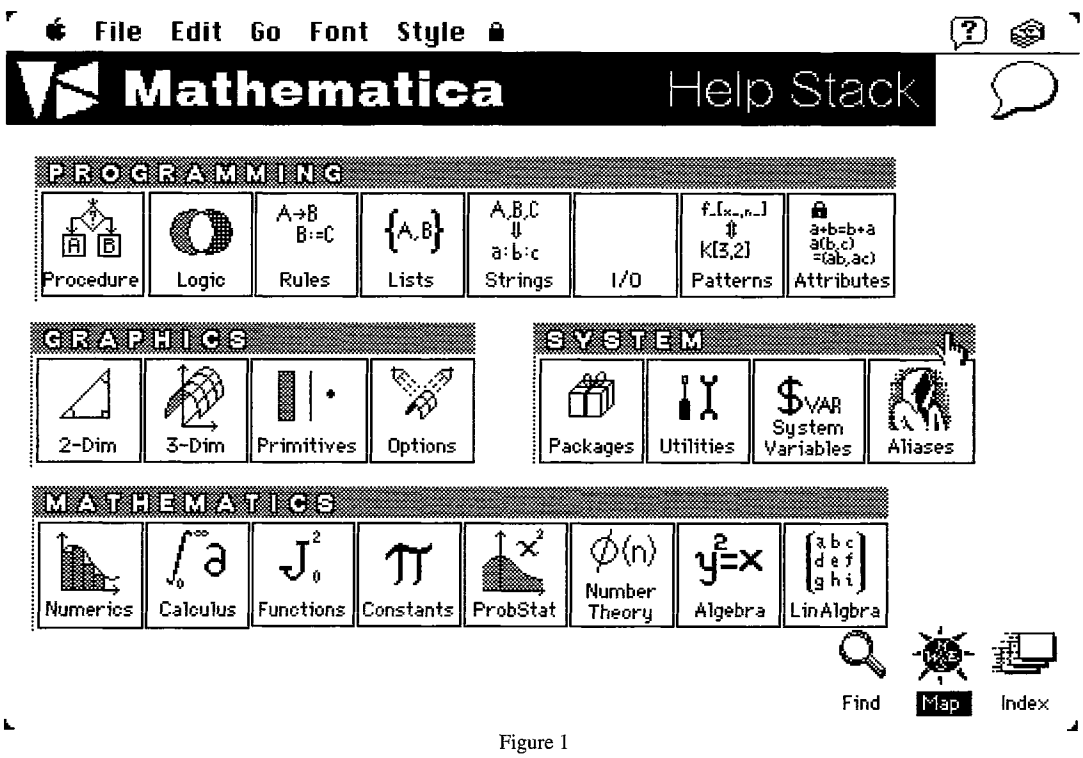


Figure 1

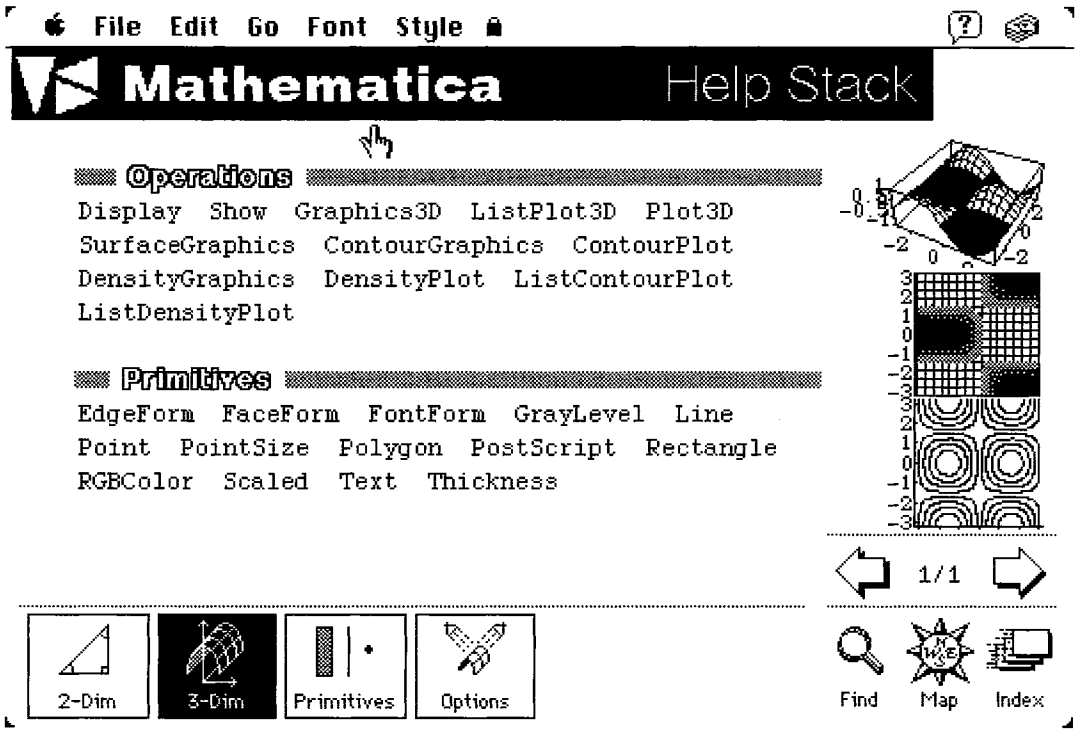


Figure 2

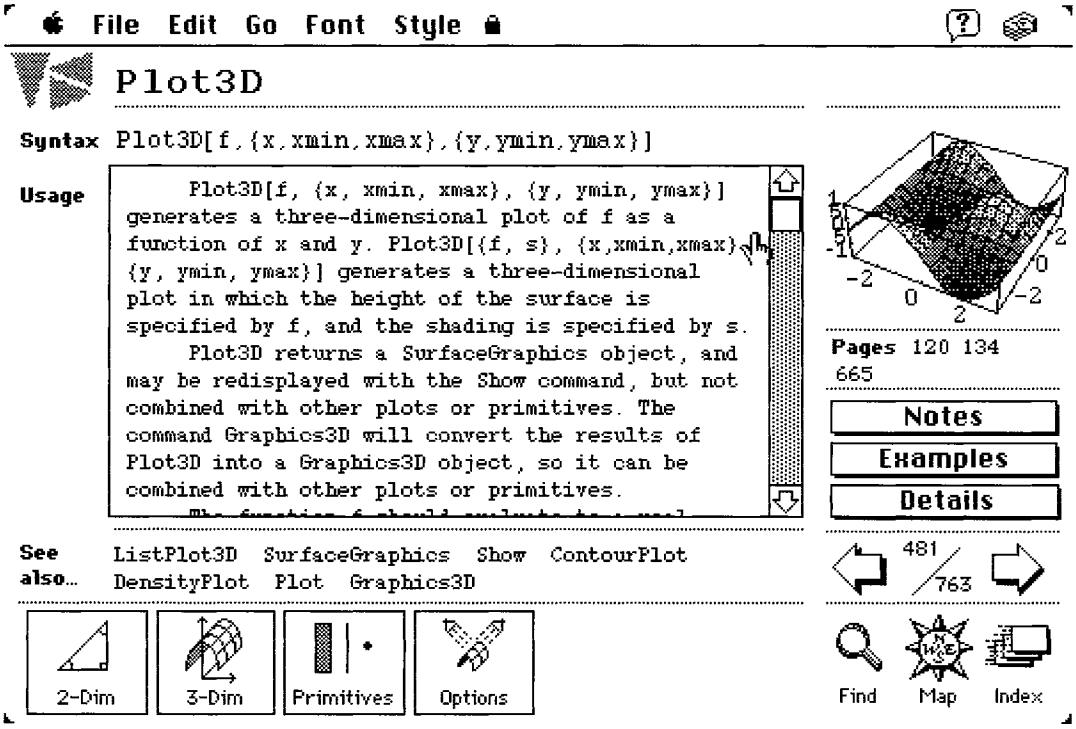


Figure 3

I find *Help Stack* most helpful with the usage of graphics-related functions and mathematical functions (e.g., `NullSpace`); however, it is my opinion that *Help Stack* could do more for the novice *Mathematica* user. There is little information in *Help Stack* on getting started with *Mathematica*. For example, one cannot find information on how to define something simple like the squaring function `f[x_] = x^2`. Furthermore, if the novice knows enough to look up `Set` and `SetDelayed`, he or she would find the nonilluminating examples `x = 3`, `x^n_ = x^Mod[n, 3]` (which results in an error message from *Mathematica*), followed by a series of examples that show the difference between `Set` and `SetDelayed`.

I also find *Help Stack* of limited use for those interested in *Mathematica* programming. Important *Mathematica* programming constructs have often insufficient and sometimes incorrect examples. For instance, in the examples for `Apply` there are the two input/output pairs: `f @@ g[a, b]` which returns `f[a, b]`, and `f /@ g[a, b]` which is claimed to return `f[g[a,b]]`. The first is correct, although it does not do justice to the real utility of `Apply`; an example like `Plus @@ {a, b, c}` which returns `a + b + c` would be better. The second is supposed to show a comparison with Map and is just plain wrong.

There are many examples that appear to be transcripts from actual *Mathematica* sessions. This seems like an extremely good idea; but in testing some of these examples, the results

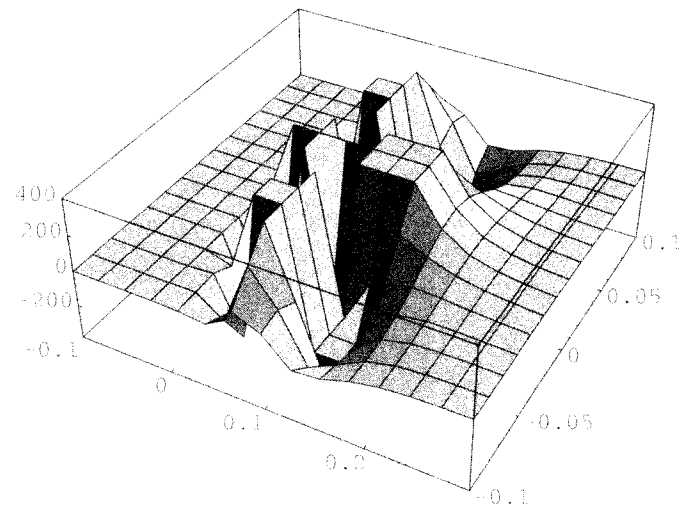


Figure 4

returned by *Mathematica* were sometimes different. For example, in the often misunderstood *Mathematica* attribute `OneIdentity`, there is the sample input `f[a] == f[f[a]]` which is claimed to produce `False` or otherwise, depending on the `OneIdentity` attribute of `f`. In an actual *Mathematica* session with the same examples, the original expression is always returned.

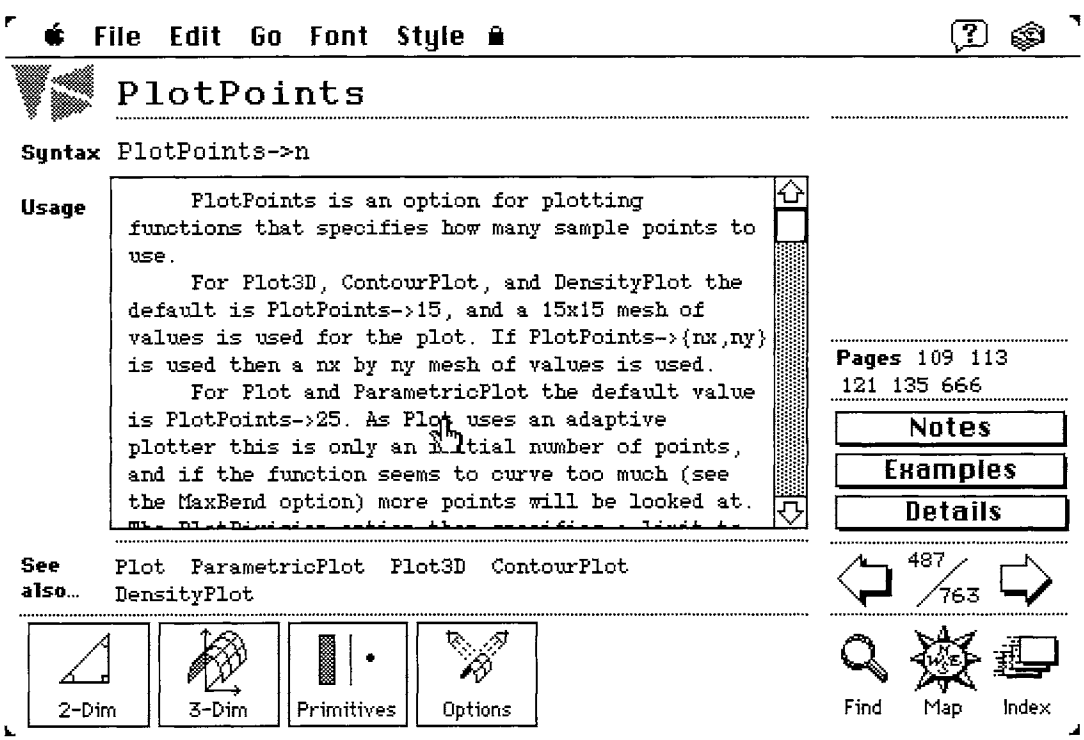


Figure 5

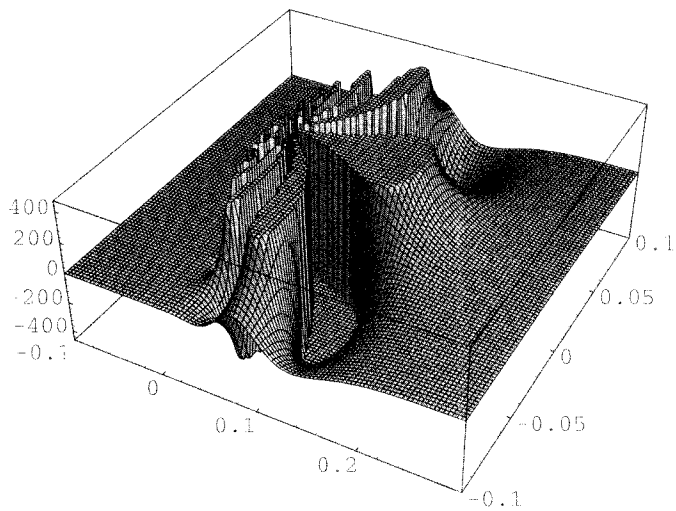


Figure 6

Help Stack performed bug free for the ten hours I used the program. The program is self-documenting; the only documentation that comes with the program are directions for installation and start up. My recommendations for *Help Stack* are to update it so that it is consistent with version 2 of *Mathematica* and to produce all examples from real *Mathematica* sessions. I would be interested in using such an updated version, especially for producing graphics that require lots of user adjustments to the *Mathematica* options.

Also included with the software sent to me was the pamphlet *Mathematica–Quick Reference Guide*. This pamphlet is a small dictionary of version 1.2 *Mathematica* functions, a mini version of the reference guide found in the back of the *Mathematica* book. It lists *Mathematica* functions in alphabetical order, shows the syntax of the function, and has a short explanation of the function. This information is the same information obtainable from inside *Mathematica* with the command `?(symbol)`. The reference guide also shows related functions and references the page(s) in the *Mathematica* book where the function is discussed. An appendix to the guide gives the same information for all functions in the packages distributed with version 1.2 of *Mathematica*.

Mathematica Help Stack ($89) and the *Quick Reference Guide* ($14.95) are sold by Variable Symbols, 2161 Shattuck Avenue, Suite 202, Berkeley, CA 94704. A free demonstration program is also available.

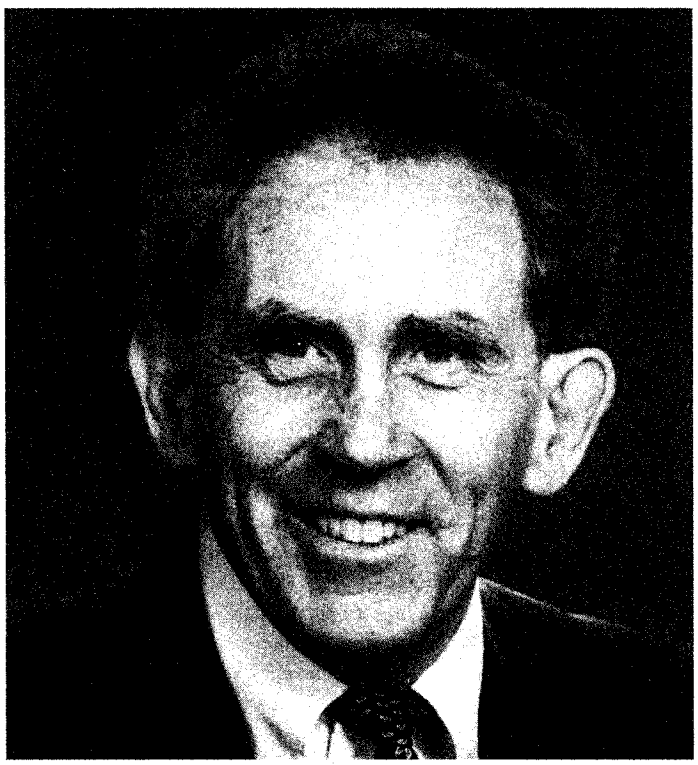
Reference

[1] S. Wolfram, *Mathematica, a system for doing mathematics by computer*, Addison Wesley, 1988.

Inside the AMS

Donald Babbitt Appointed AMS Publisher

Donald G. Babbitt, formerly executive editor of *Mathematical Reviews*, has been appointed publisher of the AMS. In this capacity, he will direct all aspects of the Society's publishing operations, from acquiring manuscripts to fulfilling orders for finished volumes. He will oversee a staff of nearly one hundred in four departments: Acquisitions, Production, Electronic Products and Services, and Marketing and Sales.



Donald G. Babbitt

"Don is very interested in all aspects of publishing, has a terrific knowledge of mathematical literature, and has done an excellent job at *Mathematical Reviews*," says AMS Executive Director William H. Jaco. "We're very happy to have him on board at AMS headquarters in Providence."

"The role of the publisher, as I see it, is to implement the policies and vision of the volunteeer leadership of the Society in as economical and efficient way as possible," says Babbitt. "I also feel the publisher should attempt to anticipate future trends in academic publishing and carry on a dialogue on these matters with the appropriate volunteer leadership. These are exciting times in academic publishing because of the electronic revolution in producing and disseminating information."

A More Active Publication Program

Before Babbitt started at *Mathematical Reviews* in 1992, he was professor of mathematics at the University of California at Los Angeles. He received his Ph.D. in 1962 from the University of Michigan. His research areas are mathematical physics and differential equations in the complex domain. He has held visiting positions at a number of institutions, including Indiana University (1966), the Institute for Advanced Study (1970–1971), and the University of Virginia (1975). He also served on various administrative committees at UCLA and served as associate dean of the graduate division.

The publisher, a new AMS position, was created to help advance the Society's efforts to develop a more active publication program. The AMS Strategic Planning Task Force set forth the goal of "making the AMS the publisher of choice for mathematicians." Reaching this goal means making progress on a number of fronts, including improved acquisition activity, effective marketing and promotions, world-wide distribution, economies of production, innovations in electronic delivery, and a broader publications list with increased back-volume sales.

In particular, over the past two years, the AMS has aimed at a more organized, systematic acquisitions effort. Together with Manager of Russian Translations Sergei Gelfand, who has now been assigned to world-wide acquisitions, Babbitt will put special focus on acquisitions to expand the AMS book-publishing program. "We are operating on the philosophy that the Society has a responsibility to provide and communicate the best mathematics possible to the community," notes Jaco. "This is why we're looking at how we serve the community with our book-publishing program and why the publications program has to have a strong and clear sense of direction. I think that having Don and Sergei as the AMS acquisitions team positions us with one of the best acquisition efforts in mathematical publishing."

The Electronic Revolution

The rise of electronic delivery of information has also presented the AMS with many challenges. With preprint servers, electronic journals, electronic research announcements and the like, dramatic changes are occurring in how scholarly publications are delivered. The Society's role in this area must adapt to these changes. The changes in electronic delivery have had an impact on production as well: the Society has been moving the major part of its book production from typeset books to author-prepared books. In addition, this year there will be an experiment to move a primary journal in this direction. The increasing use of author-prepared texts has "led to the yet-to-be-realized expectation that AMS publications should be much cheaper to produce and consequently much cheaper for libraries and individuals to buy," Babbitt notes. "The challenge is to somehow efficiently and cheaply translate the various dialects of TEX used by authors into a canonical TEX format."

Services Supported by Publishing

As a nonprofit organization, the AMS provides many valuable services to the mathematical sciences community that do not result in income to the Society and are indirectly supported by the publications program. A strong publications program ensures that the Society can continue to provide such services. In addition, the AMS has as one of its central aims the communication of mathematical sciences research. Building a publications program that meets the community's needs for high-quality, cost-effective publications will help achieve this aim.

Sergei Gelfand (left) and Don Babbitt, AMS acquisitions team

However, Babbitt believes that the electronic revolution in publishing almost certainly will reduce the important revenue derived from the Society's primary journals. "Other sources of revenue will need to be found if the AMS is to continue to provide the variety of services it does and if other worthwhile projects are to be created," he says. "One of the most promising solutions would be the development of a more robust and broader book-publishing program."

"I believe the Society wants to take up the challenge to address these issues," Babbitt declares. "This will require the cooperation and efforts of the publisher, all of the AMS departments associated with publishing, and the volunteer leadership of the Society. I look forward to working with all of them."

Allyn Jackson

Ethical Guidelines Drafted by AMS Council

Editor's note: This article is being reprinted to include information that was inadvertently omitted when the article first appeared in April 1994 *Notices*. Details on how to submit comments and suggestions regarding the proposed guidelines now appear in paragraph two of the article below.

The Council of the AMS is seeking comments on a set of ethical guidelines drafted by the ad hoc Committee on Professional Responsibility. The proposed guidelines and some introductory material are presented here.

The Council of the American Mathematical Society, in response to several cases in the mathematical community alleging serious breaches of professional ethics and perceiving the need of a national professional society for a code of ethics, resolved in March 1992 to establish a Committee (later called the ad hoc Advisory Committee on Professional Responsibility) to make recommendations concerning the role of the Society. The committee consisted of Murray Gerstenhaber; Frank Gilfeather; Linda Keen, chair; and Elliott Lieb. After reviewing the statements on ethics published by other societies, one recommendation of this committee was that the Society should promulgate a set of ethical guidelines, a preliminary draft of which was submitted by the Committee to the Council in January 1995 and which is printed here by vote of the Council in order to solicit comments.

All members of the mathematical community are encouraged to examine carefully these proposed guidelines. Comments and suggestions should be addressed in writing to: Chair, ad hoc Committee on Professional Ethics, c/o Prof. Robert Fossum, secretary, American Mathematical Society, Department of Mathematics, University of Illinois, 1409 W. Green St., Urbana, IL 61801-2975. The Committee will examine all comments received by the secretary before September 30, 1994. Proposed final wording, revised in light of these comments, will be submitted to the Council in January, 1995.

Ethical Guidelines

To assist in its chartered goal, "... the furtherance of the interests of mathematical scholarship and research... ", and to help in the preservation of that atmosphere of mutual trust and ethical behavior required for science to prosper, the American

Mathematical Society, through its Council, sets forth the following guidelines. While the Society speaks only for itself, these guidelines reflect its expectations of behavior both for its members and for all members of the wider mathematical community, including institutions engaged in the education or employment of mathematicians or in the publication of mathematics. The guidelines are not a complete expression of the principles that underlie them but will, it is expected, be modified and amplified by events and experience.

The American Mathematical Society, through its Committee on Professional Ethics (COPE), accepts the responsibility of providing an avenue of redress for individual members injured in their capacity as mathematicians by violations of its ethical principles.

I. Mathematical Research and Its Presentation

The public reputation for honesty and integrity of the mathematical community and of the Society is its collective treasure, and its publication record is its legacy.

The correct attribution of mathematical results is essential, both as it encourages creativity by benefiting the creator whose career may depend on the recognition of the work and as it informs the community of when, where, and sometimes how original ideas have entered into the chain of mathematical thought. To that end mathematicians have certain responsibilities which include the following: To be knowledgeable; to be aware of related work; to be certain of the originality of their own work; to give proper credit even to unpublished sources because the knowledge that something is true or false is valuable, however it is obtained; to use no language that suppresses or improperly detracts from the work of others; and to correct in a timely way or withdraw work that is erroneous or previously published. On appropriate occasion it may be desirable to offer or accept joint authorship when independent researchers find that they have produced identical results. However, the authors listed for a paper must all have made a significant contribution to its content, and all who have made such a contribution must be offered the opportunity to be listed as an author. A claim of independence may not be based on ignorance of well-disseminated results, and it must be convincing. A mathematician may not claim a result in advance of its achievement, for that injures the community by restraining those working toward the same goal. Publication of results that are announced must not be unreasonably delayed.

Because the free exchange of ideas necessary to promote research is possible only when every individual's contribution is properly recognized, the Society will not knowingly publish anything that violates this principle, and it will seek to expose violations anywhere in the mathematical community.

II. Social Responsibility of Mathematicians

The Society promotes mathematical research together with its unrestricted dissemination, and to that end encourages all and will strive to afford equal opportunity to all to engage in this endeavor. Mathematical ability must be respected wherever it is found, without regard to race, gender, ethnicity, sexual orientation, or religious or political belief.

The growing importance of mathematics in society at large and of public funding of mathematics may increasingly place members of the mathematical community in conflicts of interests. Even the appearance of bias in reviewing, refereeing, or in funding decisions must be scrupulously avoided, particularly where decisions may affect one's own research, that of close colleagues, or of one's students; in extreme cases one must withdraw.

Any relevant relationship between a person asked for a report and someone named in it, whether or not it involves funding, should be explicitly revealed.

A reference or referee's report fully and accurately reflecting the writer's views is often given only on the understanding that it be confidential or that the name of the writer be withheld from certain interested parties; therefore, a request for a reference or report must be assumed, unless there is a statement to the contrary, to carry an implicit promise of confidentiality or anonymity which must be carefully kept unless negated by law. The writer of the reply must respond fairly, withhold no essential information of which the writer is aware, and keep confidential any privileged information, personal or mathematical, which the writer receives. When information received with the request substantially affects the writer's own work, the report must reveal that fact. If the requesting individual, institution, agency, or company becomes aware that confidentiality or anonymity cannot be maintained, that must immediately be communicated and, if known in advance, must be stated in the original request.

Where choices must be made and conflicts are unavoidable, as with editors or those who decide on appointments or promotions, it is essential to keep careful records which, even if held confidential at the time, would, when opened, demonstrate that the process was indeed fair.

Freedom to publish must sometimes yield to security concerns, but mathematicians should resist excessive secrecy demands, whether by government or private institutions.

In those instances where mathematics impacts on the "real world" it is the duty of mathematicians to disclose to their employers and to the public, if necessary, the implications of their work, particularly when the impact may be on the public health, safety, or general welfare. This includes disclosing knowledge of false or overblown claims.

It is the duty of individual mathematicians to reveal unethical professional acts or practices of which they may have knowledge. When this may bring retaliation, the Society is obligated to help protect the "whistleblower", particularly when the complaint has been made to the Society.

III. Education and Granting of Degrees

Holding a Ph.D. degree is virtually indispensable to an academic career in mathematics and is becoming increasingly important as a certificate of competence in the wider job market. An institution granting a degree in mathematics is certifying that competence and must take full responsibility for it by insuring the high level and originality of the thesis

work and sufficient knowledge by the recipient of important branches of mathematics outside the scope of the thesis. A thesis must adhere to the same rules as a publication and should be publishable in a recognized journal. When, despite diligent search by the candidate and without the candidate's knowledge or fault, the work is found to have been anticipated in the literature, the degree should be granted. But when there is evidence of plagiarism, it must be carefully investigated, even if it comes to light after granting the degree, and, if proven, the degree should be revoked.

IV. Publications

The Society will not publish, print, promote, or aid in the publishing, printing, or promoting of any research journal where there is some criterion for acceptance of a paper other than its content. It will promote the quick refereeing and timely publication of articles accepted to its journals.

Editors are responsible for the timely refereeing of articles and must judge articles by the state of knowledge at the time of submission.

If the contents of a paper become known in advance of publication solely as a result of its submission to or handling by a journal, and if a second paper based on knowledge of the privileged information is received anywhere by an editor aware of the facts, then unless the first author agrees the editor must refuse or delay publication of the second paper until after publication of the first.

At the time a manuscript is submitted editors should notify authors whenever a large backlog of accepted papers may produce inordinate delay in publication; notice of these backlogs should also be published openly. A journal may not delay publication of a paper for reasons of an editor's self-interest or of any interest other than the author's. Editors must be given and accept full scientific responsibility for their journals; when a demand is made by an outside agency for prior review or censorship of so-called "sensitive" articles, that demand must be resisted, and, in any event, knowledge of the demand must be made public.

All mathematical publishers, particularly those who draw without charge on the resources of the mathematical community through the use of unpaid editors and referees, must recognize that they have made a compact with the community to disseminate information, and that compact must be weighed in their business decisions.

Both editors and referees must respect the confidentiality of materials submitted to them unless these have previously been made public and above all may not appropriate to themselves ideas in work submitted to them or do anything that would impair the rights of authors to the fruits of their labors. Editors must preserve the anonymity of referees unless there is a credible allegation of misuse.

These are ethical obligations of all persons or organizations controlling mathematical publications, whatever their designation.

Washington Outlook

This month's column is written by Lisa A. Thompson, who is the Assistant for Governmental Affairs of the Joint Policy Board for Mathematics (JPBM).

Mathematical Sciences in the FY 1995 Budget

Summary and Highlights

- Despite the lack of real growth (actual and proposed) in overall federal support for basic research in FY 1993–1995, funding for the mathematical sciences would grow steadily in real terms during this time period.
- Although the level of support for the mathematical sciences dipped in FY 1993, it would recover in FY 1994, rising by an estimated 5 percent, and under agency proposals would continue to rise in FY 1995, by just over 6 percent; reductions from proposed levels due to congressional action, however, are likely to occur.
- Growth in federal funding for the mathematical sciences continues to be driven by research initiatives in areas of national importance.
- The NSF Division of Mathematical Sciences is responsible for much but not all of the estimated and proposed spending increases; its FY 1995 budget would be 7.9 percent higher than the estimated FY 1994 budget, which is nearly 6 percent higher than the amount spent in FY 1993.
- Despite a sharp cut in defense basic research spending in FY 1994 and no real growth proposed in FY 1995, total support for the mathematical sciences from DOD would grow at a pace exceeding inflation in FY 1993–1995.
- While the budgets of most activities funded through the DOE basic energy sciences account are facing cuts, the Office of Scientific Computing, and thus support for the mathematical sciences, would be spared; although proposed FY 1995 support for the mathematical sciences would remain at the FY 1994 level, this level is an estimated 6.1 percent greater than FY 1993 spending.

The FY 1995 Federal Budget

President Clinton presented his FY 1995 budget plan to Congress in early February, a budget that adheres to the five-year, $500-billion deficit reduction plan enacted last summer. For the first time in over two decades, total federal discretionary spending will decline in real, inflation-adjusted terms, primarily due to defense cuts. The proposal includes deep cuts in programs across the government to cover not only deficit reduction but also to finance Clinton's investment initiatives, among them education and R&D.

Although there will be winners and losers among R&D programs, overall federal R&D spending would increase by 4 percent over the FY 1993 level. Support for civilian basic research would increase by 2 percent to about $12.9 billion, while support for civilian applied research and development would increase by 5 percent to $18.6 billion. Among the big winners: NIST R&D programs would increase by 78 percent, and funding for the National Information Infrastructure (including the High-Performance Computing and Communications initiative) would increase by 32 percent. Transportation R&D would increase by 25 percent. R&D programs in manufacturing , global climate change, and biotechnology are also among the priority areas. Overall support for university research would increase by 4 percent to about $12.2 billion.

The proposed R&D budget would maintain the current ratio of defense R&D to civilian R&D at 53:47, despite earlier pronouncements from the administration that it would emphasize civilian R&D at the expense of military R&D. At a briefing, OSTP Director Jack Gibbons noted that increasing portions of the budgets of the Advanced Research Projects Agency and other DOD agencies are devoted to dual-use technologies, and this should be counted as progress toward the optimum. He also implied that the FY 1996 budget would show a more notable shift away from military R&D.

Gibbons also outlined the administration's science and technology strategy, consisting of the following six principles: maintain R&D funding as a priority investment, increase focus on new relevant national goals, expand partnerships with private sector, ensure leadership in fundamental research, improve strategic coordination of R&D programs, and seek opportunities for international cooperation. The new cabinet-level National Science and Technology Council and its nine committees will be responsible for implementing these strategies. The committees, many of which had precursors under the now-defunct FCCSET, are working to integrate federal R&D programs in support of overarching national goals to be set by the council.

As Congress acts on the budget during the spring and summer, there will be two sources of pressure holding down growth in R&D and the rest of Clinton's investment package. First, supporters of programs the President has cut will try to get some of that funding back. Second, congressional deficit hawks want budget cuts used to reduce the deficit, not to finance increases elsewhere. While the first factor will undoubtedly have an impact on the margins in each appropriations bill, the second has the potential to wipe out new spending in one sweep. Last November an additional deficit reduction plan failed on the House floor by only six votes. Six more votes for deficit reduction could be easy to find in an election year.

Trends in Federal Support for the Mathematical Sciences

For several years through FY 1992, federal support for the mathematical sciences grew by roughly 2 or 3 percent above inflation annually, a rate consistent with the growth in overall federal support for basic research. Since FY 1993, however, estimated and proposed federal support for basic research would grow very little, barely keeping pace with inflation. It appears, though, that estimated and proposed funding for the federal mathematical sciences programs would allow for real growth in FY 1994 and FY 1995. This growth would be on an FY 1993 base that represented the first real decrease in combined support for the mathematical sciences programs in recent times.

Because the federal basic research budget increasingly favors thematic, multiagency research initiatives and other interdisciplinary activities, it is not entirely surprising that the mathematical sciences—a fundamental discipline that permeates science and technology and enables progress in many research areas—would fare relatively well under this scheme. Indeed, these strategic programs in support of national objectives account for much of the recent growth in mathematical sciences program budgets, providing mathematical scientists with important opportunities and mechanisms to contribute more directly to solving the increasingly sophisticated problems found in the other sciences, technology, and industry.

Similarly, DOD support for the mathematical sciences largely depends on the extent to which the field has the potential to contribute to the technology thrusts established at the highest levels of the department. That mathematical tools and methods underpin many areas of importance to the military—areas such as communications, signal processing, and image analysis and recognition—could explain the combined growth in the budget estimates and proposals for the five mathematical sciences programs supported by the DOD. Moreover, the Pentagon's expanded mandate to support dual-use technologies—such as high-performance computing and advanced materials and manufacturing—could also account for the programs' funding outlook.

The increasing emphasis on strategic areas throughout the federal research system raises questions about the future of adequate support for research in core mathematics. The provision of funds largely according to potential to expand the frontiers of mathematical knowledge enhances the ongoing availability of the mathematical sciences as a broad and versatile resource for the nation. While the strategic research programs encompass many traditional areas of mathematical research, they have caused shifts in the distribution of support across the discipline. This is especially true at the NSF, which is virtually the only source of support for fundamental mathematical research aimed at expanding the intellectual frontiers of mathematics. It is particularly problematic that the balance between fundamental and strategic research in the mathematical sciences is not guided by an explicit well-founded principle, but rather by the vagaries of the budget process.

It should be noted that the increasingly quantitative nature of research in general hinders the complete accounting of federal support for mathematical scientists. For instance, NSF makes awards to Grand Challenges Applications Groups, multidisciplinary teams seeking to apply high-performance computing techniques and resources to fundamental problems in science and engineering with broad economic and scientific impact. The involvement of the mathematical sciences in such an activity would not necessarily be reflected in the budget figures presented here.

Mathematical Sciences Program Budgets for FY 1995

The table at the end of this article gives budget figures for the seven federal mathematical sciences programs, including estimates of spending in FY 1994 and budget proposals for FY 1995. All figures shown in the table and cited below are in terms of current dollars.

Each program provides support for a variety of research and related activities, including individual and group awards, institutes and centers, equipment, and education and human resources development. The figures given in the table include funds spent or estimated to be spent on these various components of the mathematical sciences enterprise by each of the programs.

In FY 1995 combined spending by the seven mathematical sciences programs would grow by 6.2 percent above the estimated FY 1994 level. The budgets for four programs would grow in the FY 1994, while budgets for three would remain flat. These budget proposals, however, are subject to the congressional budget process and to future revision by the responsible agencies. In particular, if recent trends hold, Congress is unlikely to fully fund the NSF request for research activities, and the proposed 7.2 percent increase in support for the mathematical sciences would drop accordingly. Similarly, congressional cuts in the defense R&D budget request could bring down the proposed spending levels of the DOD programs.

The DOD program figures might include funding for several DOD-wide add-on programs, including: Augmentation Awards for Science and Engineering Research Training (AASERT), the National Defense Science and Engineering Graduate Fellowship Program (NDSEG), the Research Initiation Program (RIP), Small Business Innovation Research (SBIR), and the University Research Initiative (URI). These add-on programs, often earmarked by Congress, are funded

separately and later distributed within each of the DOD research agencies. This causes fluctuations in budget figures at the program level as they are reported from one year to the next.

National Science Foundation (NSF)
The NSF Division of Mathematical Sciences (DMS) fosters the creation and development of mathematical and statistical ideas and techniques, supports their interaction with theory and practice in other scientific and engineering disciplines, and encourages their diffusion into the infrastructure for education and human resource development and the technology base.

DMS provides about half of all federal support for the mathematical sciences, covering the broadest range of mathematical fields with support for individual investigators and small groups, research institutes and centers, shared computing equipment, postdoctoral fellowships, research conferences, and undergraduate programs.

In FY 1995 DMS would support further participation of the mathematical sciences in interagency and NSF- and directorate-wide research initiatives, including those focused on high-performance computing and communications, advanced manufacturing technology, global change, biotechnology, civil infrastructure systems, environmental research, and nonlinear science. This reflects "both the importance of mathematical modeling, simulation, control, visualization, and algorithm development and the readiness of the mathematical sciences to enhance research in these areas," according to budget documents.

DMS also plans to expand its education activities, in particular Research Experiences for Undergraduates and postdoctoral fellowships. In FY 1994 the division began an industrial postdoctoral fellowship program in which new Ph.D.s spend part of their time in industry and part of their time in academia. This program is one of NSF's pioneering efforts to improve collaboration between academia and industry.

The FY 1994 current plan estimates DMS spending at $82.2 million, an increase of 5.9 percent above FY 1993 spending. The DMS budget request for FY 1995 would be $88.7 million, a proposed increase of 7.9 percent above the FY 1994 estimate.

The FY 1995 budget proposal would be distributed among three program elements, as follows: $49.0 million for disciplinary research, an increase of 5.1 percent above the FY 1994 estimate for this element; $20.0 million for cross-disciplinary and computational research, an increase of 15.2 percent; and $19.7 million for special projects, an increase of 8.2 percent.

Air Force Office of Scientific Research (AFOSR)
The Mathematical and Information Sciences Directorate of AFOSR provides funds for activities in the mathematical sciences in support of the Air Force mission. Because Air Force funding for basic research was cut significantly, the directorate will spend about $0.6 million less in FY 1994 than it did in FY 1993, although additional FY 1994 funds might be allocated from URI monies, which have not been distributed among AFOSR's directorates at press time. The directorate estimates it would spend $17.5 million for the mathematical sciences in FY 1995.

Army Research Office (ARO)
The ARO Mathematical Sciences Program focuses on the mathematics of materials science, high-performance computing, stochastic methods in image analysis, mathematical and computational issues in intelligent manufacturing, and other areas of interest to the Army. The program estimates it will spend $15.0 million in FY 1994 and proposes a like amount for FY 1995. In FY 1995 the program would continue to fund various centers and institutes, including the Army High Performance Computing Research Center.

Advanced Research Projects Agency (ARPA)
The Applied and Computational Mathematics Program (ACMP) at ARPA supports mathematical research on innovative approaches to signal and image processing and communications, in particular wavelets and their applications, and innovative approaches to large-scale computation. In FY 1993 it added a focus on mathematical approaches to signal and image processing relevant to automatic detection and recognition of objects. In FY 1994 the agency began support for mathematical research on theory, modeling, and computational simulation of materials and materials processing as part of the federal Advanced Materials and Processing Program. ARPA also seeks collaborative efforts between universities and industries where appropriate to foster the transition of ideas to applications and to provide a source for problems in applied mathematics.

The program is also augmented with funds from the DOD add-on programs, including URI awards for two centers. The RIP program provides support in the areas of modeling and simulation in manufacturing and theory and modeling for optical communications. Funds are also provided through the SBIR program, although they are not included in the figures given in the table.

The FY 1994 budget estimate includes $11.7 million for the base program, $2.0 million for participation in the federal materials program, and $4.7 million for URI and RIP activities. In FY 1995 spending would total $21.5 million; this estimate includes $13.9 million for the base program, $4 million for the materials initiative, and $3.6 million for the add-on programs.

National Security Agency (NSA)
The NSA Mathematical Sciences Program supports research in algebra, number theory, discrete mathematics, probability, statistics, and cryptology and awards four kinds of grants: the Young Investigators Grant, the Standard Grant, the Senior Investigators Grant, and the Conferences and Special Situations Grant.

Due to overall spending cuts at the agency, support for the Mathematical Sciences Program has been dropping since FY 1990, when spending peaked at over $3.1 million. The

FY 1994 budget estimate is $2.25 million, and the FY 1995 proposal is $2.5 million. NSA provides additional funds through a program to support the mathematical sciences at minority institutions. In FY 1993, for instance, the program distributed $1.6 million.

Office of Naval Research (ONR)

The Mathematical Sciences Division of the Office of Naval Research funds research in support of the naval mission, with designated programs in the areas of applied analysis, discrete mathematics, numerical analysis, operations research, probability and statistics, and signal analysis. It maintains a base program and also funds accelerated research initiatives (ARIs) as needed.

In FY 1994 the division estimates spending a total of $17.0 million, including about $9.4 million on the base program, $5.6 million on ARIs, and $2.0 million on DOD add-on programs, including $1.4 million from AASERT. The division roughly estimates that the proposed FY 1995 budget would be constant at the FY 1994 level.

Department of Energy (DOE)

The DOE Office of Scientific Computing has two missions: to ensure the broad range of research in the mathematical and computer sciences necessary to underpin all the other sciences and to manage an international network to provide state-of-the-art supercomputing facilities for DOE-supported researchers. Its work is proceeding in the context of the government-wide High Performance Computing and Communications (HPCC) initiative, which encompasses R&D needed to produce the next generation of high-performance computing hardware and software.

While overall support for DOE scientific computing has grown somewhat over the past few years because of its focus on HPCC, spending increases are directed to applied work on "Grand Challenge"-class computational problems. Support for basic mathematical sciences—including research and related activities in analytical and numerical methods and information analysis techniques at universities and national laboratories—would remain unchanged in FY 1995 from an estimated level of $15.7 million in FY 1994. This latter estimate, which implies an increase of 6.1 percent over FY 1993 spending, is still subject to change under rescissions Congress imposed on energy supply R&D in early 1994.

Other Federal Agencies

Several agencies—for instance, the National Aeronautics and Space Administration, the National Institutes of Health, and the National Institute of Standards and Technology—support mathematical sciences research, largely as an intramural activity. These and other agencies, such as the Environmental Protection Agency and the Department of Transportation, do supply a limited number of grants to academic mathematical scientists. The table shows a rough, low-end estimate of $1.0 million for extramural support from federal agencies without dedicated mathematical sciences programs.

FEDERAL SUPPORT FOR THE MATHEMATICAL SCIENCES

FY 1992–1995, in millions, current dollars

	actual FY 92	actual FY 93	current plan FY 94	budget request FY 95	% change FY 94–95
National Science Foundation, total	86.42	85.62	90.21	96.71	7.2%
DMS	78.42	77.62	82.21	88.71	7.9%
Other	8.00	8.00	8.00	8.00	0.0%
Department of Defense, total	67.68	66.43	69.07	73.39	6.3%
AFOSR	17.00	17.00	16.40	17.50	6.7%
ARO	13.50	13.00	15.00	15.00	0.0%
ARPA	17.80	16.65	18.42	21.49	16.7%
NSA	3.10	2.40	2.25	2.40	6.7%
ONR	16.28	17.38	17.00	17.00	0.0%
Department of Energy, total	13.50	14.80	15.70	15.70	0.0%
University Support	5.40	5.40	6.20	6.20	0.0%
National Laboratories	8.10	9.40	9.50	9.50	0.0%
Other Agencies	1.00	1.00	1.00	1.00	0.0%
TOTAL	168.60	167.85	175.98	186.80	6.2%

DMS = Division of Mathematical Sciences; AFOSR = Air Force Office of Scientific Research; ARO = Army Research Office; ARPA = Advanced Research Projects Agency; NSA = National Security Agency; ONR = Office of Naval Research.

News and Announcements

Herbert Busemann 1905–1994

Herbert Busemann died on February 9, 1994. With his death mathematics lost a great true geometer of the twentieth century.

In his habilitation lecture of 1854 Riemann proposed the geometry on a manifold based on an element of arc. Its most important case, where the square of the element of arc is a quadratic differential form, is nowadays called Riemannian geometry. The general case, which Riemann did not exclude from his consideration, is to be called Finsler geometry, because Finsler wrote a thesis on it in 1918. Beginning with the solution of the form problem by E. Christoffel and R. Lipschitz in 1869 and through the application of the tensor analysis of Ricci and Levi-Civita, Riemannian geometry has had a vigorous development by analytic methods.

Busemann developed Finsler geometry by a purely geometrical approach. It was both original and powerful. There were several geometrical epochs in the history of mathematics symbolized by names such as J. Steiner, D. Hilbert, K. Menger, and G. Bouligand. Busemann went further and included treatment of curvature and geodesics.

Synthetic geometry is difficult, because each problem needs at least one new idea; it does not have a machinery which has general applications. As a result the subject has a built-in unpopularity. But it is enjoyable, and the insight gained is usually beautiful and deep.

Busemann was a professor at the University of Southern California, 1947–1964, and a distinguished professor from 1964 until his retirement in 1970. He was a member of the Royal Danish Academy. In 1985 he was awarded the Lobachevsky Prize by the Academy of Sciences of the USSR, whose recipients included S. Lie, David Hilbert, Henri Poincaré, Elie Cartan, H. Hopf, and others. He fully deserved the honor.

AMS Centennial Fellowships Awarded

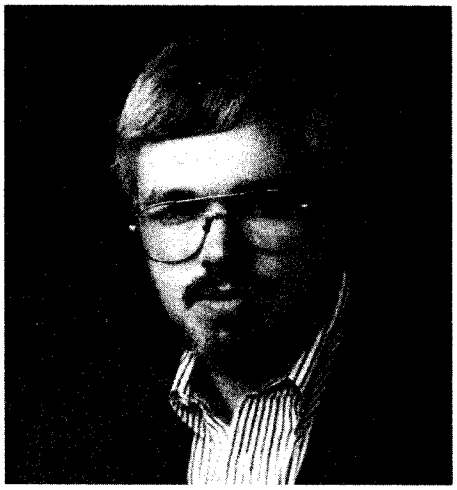
The Society has awarded two Centennial Fellowships for 1994–1995. The recipients are PATRICIA BAUMAN of Purdue University and DAVID MARKER of the University of Illinois at Chicago.

Patricia Bauman, Centennial Fellow, 1994–1995

Patricia Bauman

Patricia Bauman received her Ph.D. in 1982 from the University of Minnesota, Minneapolis, under the direction of Gene Fabes. After a year as a National Science Foundation Postdoctoral Fellow and visiting member at the Courant Institute, in 1983 she became a C.L.E. Moore Instructor at the Massachusetts Institute of Technology. Since 1984 she has been at Purdue University, with a leave during 1990 at the Institute for Mathematics and its Applications and the University of Minnesota in Minneapolis. She is currently an associate professor of mathematics at Purdue University.

Bauman's research has focused on partial differential equations in several space dimensions and applications. Most recently she has investigated the qualitative behavior of solutions to nonlinear systems arising from mathematical models of elastic deformations and superconducting materials. She considers herself fortunate to have collaborated with Neil Carlson, Chao-Nien Chen, Nick Owen, Dan Phillips, and Peter Sternberg.



David Marker, Centennial Fellow, 1994–1995

David Marker

David Marker received his Ph.D. in 1983 from Yale University under the direction of Angus Macintyre. He spent two years at the University of California at Berkeley as a National Science Foundation Postdoctoral Research Fellow. In

1985 he joined the University of Illinois at Chicago as an assistant professor and was promoted to associate professor in 1989. He spent the fall semester of 1989 as a member of the Mathematical Sciences Research Institute.

Marker's research is in mathematical logic. He is particularly interested in applications of model theoretic methods in algebra and geometry.

Information about the competition for the 1994–1995 AMS Centennial Fellowships will be published in the "Funding Information for the Mathematical Sciences" section of the next issue of the *Notices*.

Ratner Receives NAS Carty Award

MARINA RATNER of the University of California at Berkeley has received the John J. Carty Award for the Advancement of Science from the National Academy of Sciences. Professor Ratner was honored "for her striking proof of the Raghunathan conjectures".

The purpose of the Carty Award is to recognize noteworthy and distinguished accomplishment in any field of science. The award, consisting of a medal, an illuminated scroll, and $25,000, were presented to Professor Ratner during the NAS awards ceremony on April 25, 1994.

About Ratner's Work

The following description of the work of Professor Ratner was supplied by her Berkeley colleague, Jacob Feldman.

Marina Ratner's main work has been in ergodic theory and, more importantly, the use of ideas and techniques from ergodic theory in other, more classical contexts. Much of her best work has involved the discovery of various "rigidity" phenomena.

In her surprising work on horocycle flows, done in the early 1980s, the objects under discussion are algebraic or geometric (depending on viewpoint). This structure carries along with it some measure-theoretic structure, but on the surface it would seem that the measure-theoretic description of these horocycle flows contains little information about them. The surprise is that, in fact, the measure-theoretic description contains *everything*! The prototypical result is that a measure-theoretic isomorphism between horocycle flows is in fact algebraic.

Marina Ratner

Marina's much acclaimed work of the last few years—the "Raghunathan conjectures"—are a far-reaching generalization and application of these ideas to an important situation. Briefly: There was an innocent looking question, sometimes called the "Oppenheim conjecture", about the values assumed by real quadratic forms in three integer variables. This question has proven remarkably recalcitrant. About 1980, M. S. Raghunathan observed that the expected answer would follow if a certain natural conjecture about actions of Lie groups were true. The question about quadratic forms required only a special case of Raghunathan's conjecture, and in 1986 G. Margulis proved this case. However, his proof gave little insight into what was going on. Marina saw that her methods were the appropriate ones for this type of question, and eventually she gave a complete proof of Raghunathan's conjecture. Furthermore, her proofs worked in a very general context and enabled her to answer several related questions of Margulis and Raghunathan. This has led to further number-theoretic information about quadratic forms.

Here is a vaguely formulated version of one of this last group of results: a "measure-theoretic" version of Raghunathan's conjecture. Let G be a connected Lie group, Γ a lattice in G, and U a subgroup of G generated by unipotent elements of G, and let μ be an arbitrary finite measure on G/Γ invariant and ergodic under the left action of U on G/Γ. Then μ has an algebraic nature: it is the Haar measure on some homogeneous space embedded in G/Γ. So again an apparently measure-theoretic object is revealed to be algebraic.

Biographical Sketch

Marina Ratner received her M.A. in 1961 from Moscow State University and for several years worked in Kolmogorov's applied statistics group as well as in his special school for gifted high school students. Her main mathematical influences at that time were A. N. Kolmogorov and Ya. G. Sinai. In 1965 she returned to Moscow State University, finishing her doctorate in 1969 under the supervision of Sinai. She was an assistant at the High Technical Engineering School in Moscow (1969–1970), a lecturer at the Hebrew University of Jerusalem (1971–1974), and a senior teacher at the Pre-academic School of the Hebrew University of Jerusalem (1974–1975). She came to the University of California at Berkeley in 1975 as an acting assistant professor and rose to her present rank of professor in 1982.

Ratner was an Alfred P. Sloan Research Fellow (1977–1979), a Miller Research Professor at the University of California at Berkeley (1985–1986), and a John Simon Guggenheim Fellow (1987–1988). In 1992, she was elected to the American Academy of Arts and Sciences and the following year to the National Academy of Sciences. Ratner will present a plenary lecture at the International Congress of Mathematicians in Zurich in August 1994.

About the Award

The John J. Carty Award for the Advancement of Science was established upon the retirement of John Joseph Carty from the vice-presidency of the American Telephone and Telegraph Company on November 13, 1930. Dr. Carty's close associates established the award as a testimonial to his distinguished achievements and to the esteem he inspired in his many thousands of associates in the Bell system.

The purpose of the Carty Award is to recognize noteworthy and distinguished accomplishments in any field of science within the scope of the Academy charter. The award has honored contributions to physics, geophysics, biochemistry, molecular biology, earth science, agricultural sciences, and mathematics, among others. Previous recipients include Nobel Laureates Edmund B. Wilson (1936), Charles H. Townes (1961), Murray Gell-Mann (1968), and James D. Watson (1971), in addition to mathematicians John N. Mather (1978) and S.-T. Yau (1981).

Prizes of the Mathematical Society of Japan

The Mathematical Society of Japan (MSJ) has awarded three prizes for mathematical accomplishments. The MSJ's Spring Prize for 1994 has been awarded to KENJI FUKAYA of Kyoto University for his outstanding contributions to the theory of Floer homology. The 1994 Geometry Prize of the MSJ was awarded to RYOICHI KOBAYASHI of Nagoya University for his work in Einstein Kähler metrics on open algebraic manifolds, and to TADASHI NAGANO of Sophia University for his work in various fields of geometry, including a geometric construction of symmetric spaces.

Ferran Sunyer i Balaguer Prize

The Institut d'Estudis Catalans has awarded the first Ferran Sunyer i Balaguer Prize to KLAUS SCHMIDT of the University of Warwick for his monograph *Dynamical Systems of Algebraic Origin*. The prize consists of 12,000 ECU. The monograph will be published in Birkhäuser-Verlag's series "Progress in Mathematics". The awards ceremony took place on April 22, 1994, at the Institut d'Estudis Catalans in Barcelona. On that day Schmidt also presented a talk on the subject of his book.

Each year, the Ferran Sunyer i Balaguer Prize will be awarded for a mathematical monograph of an expository nature presenting the latest developments in an active area of research in mathematics in which the applicant has made important contributions. The prize honors the memory of Ferran Sunyer i Balaguer (1912–1967), a self-taught Catalan mathematician who, in spite of a serious physical disability, was very active in research in classical analysis and achieved international recognition.

Elections to the American Academy of Arts and Sciences

The American Academy of Arts and Sciences has announced the election of 184 new Fellows and twenty-six Foreign Honorary Members in recognition of their distinguished contributions to science, scholarship, public affairs, and the arts. The Academy was founded in 1780 by John Adams and other leaders of the young republic, who chartered the learned society to "cultivate every art and science which may tend to advance the interest, honor, dignity, and happiness of a free, independent, and virtuous people." With more than 3,700 Fellows and Foreign Honorary Members from a broad range of geographic, professional, and cultural backgrounds, the Academy conducts a program of scholarly projects, studies, and publications which address issues of public interest.

This election included a number of mathematical scientists. Elected as Fellows were: RONALD RAFAEL COIFMAN, Yale University; GENE H. GOLUB, Stanford University; PHILIP JOHN HOLMES, Princeton University; THOMAS KAILATH, Stanford University; ELLIOTT LIEB, Princeton University; CHARLES S. PESKIN, Courant Institute of Mathematical Sciences; WOLFGANG SCHMIDT, University of Colorado; DAVID OLIVER SIEGMUND, Stanford University; LEON MELVYN SIMON, Stanford University; ROBERT M. SOLOVAY, University of California, Berkeley; and ANDREW J. WILES, Princeton University.

Elected as Foreign Honorary Members were: HAIM BREZIS and YVES MEYER, both of Université de Paris.

Fulbright Awards Announced

The J. William Fulbright Foreign Scholarship Board and the U.S. Information Agency made over 900 Fulbright awards to academics, professionals, and independent scholars to lecture or conduct research in the academic year 1993–1994.

A number of the awards were in mathematics. The following lists the names of the awardees, their permanent institutions, and the U.S. institutions they visited. ARA ALEXANIAN of Yerevan State University in Armenia, Princeton University; MOHAMMED K. ALHALASEH of College of Science and Technology in the West Bank, University of California at Santa Barbara; ROUBEN AMBARTZUMIAN of Armenian Academy of Sciences, Temple University; MARAT M. ARSLANOV of Kazan State University in Russia, Cornell University and University of Wisconsin at Madison; DHARMANAND BABOOLAL of University of Durban at Westville in South Africa, Louisiana State University; YURI A. BAHTURIN of Moscow State University, University of Wisconsin at Madison; ANATOLY BORISSOV of Thermophysics Institute in Russia, University of Maryland at College Park; OVIDIU CARJA of Al. I. Cuza University of Iasi in Romania, University of California at Los Angeles; JAIME M. M. DE CARVALHO E SILVA of University of Coimbra in Portugal, Arizona State University; CIBELE C. CESAR of Federal University of Minas Gerais in Brazil, University of Wisconsin at Madison; DEREK S. COAD of University of Sussex in Britain, University of Michigan; LJUBOMIR I. DAVIDOV of Bulgarian Academy of Sciences, Stevens Institute of Technology; MOHAMMEDI EL HALLABI of Hassania School of Public Works in Morocco, Rice University; BAKHODIR A. ERGASHEV, Fergana State University in Uzbekistan, University of Alabama at Tuscaloosa; VLADIMIR P. GOLUBYATNIKOV of Russian Academy of Sciences, Stanford University; PAWEL M. IDZIAK of Jagiellonian University in Poland, University of California at Berkeley; VICTOR V. KONEV, University of Tomsk in Russia, Stanford University; JANINA KOTUS of Technical University of Warsaw, Lehman College of City University of New York and State University of New York at Stony Brook; ABDUL LATIF of Gomal University in Pakistan, Colorado State University; REMIGIJUS LEIPUS of Vilnius University in Lithuania, Virginia Polytechnic Institute and State University; HERBERT M. LOETHE of Teachers Col-

leges of Ludwigsburg in Germany, University of North Carolina at Charlotte; FRANCISCO X. MASSANEDA CLARES of Autonomous University of Barcelona, University of Wisconsin at Madison; VALERII V. OBUKHOVSKII of Voronezh State Pedagogical Institute, Rutgers University; VYGANTAS PAULAUSKAS of Vilnius University in Lithuania, Tufts University and Cornell University; SERGEI Y. PILYUGIN of St. Petersburg State University, Georgia Institute of Technology; PAVEL S. SHCHERBAKOV of Russian Academy of Sciences, Yale University; ALEXANDER A. VASIN of Moscow State University, University of Minnesota; LUIS VERDE-STAR of Metropolitan Autonomous University-Iztapalapa in Mexico, Massachusetts Institute of Technology; ANATOLY G. YAGOLA of Moscow State University, University of Wisconsin at Madison; and SERGEI ZAVRIEV of Moscow State University, University of Wisconsin at Madison.

Sloan Research Fellows Announced

The Alfred P. Sloan Foundation has announced the names of one hundred young scientists and economists selected to receive Sloan Research Fellowships. The fellowships provide grants of $30,000 for a two-year period and are administered by each fellow's institution. The fellows, once chosen, are free to pursue whatever research most interests them and are permitted to employ the fellowship funds in a wide variety of ways to further their research. This flexibility is often of great value to young scientists at a pivotal stage in establishing their research.

The average age of the 1994 fellows is about thirty-two years. They were selected from among hundreds of highly qualified young scientists on the basis of their exceptional promise. Since its inception in 1955, the Sloan Foundation has spent nearly $66 million to support over 2,900 young researchers.

Those receiving Sloan Fellowships in mathematics are: FRAYDOUN REZAKHANLOU, University of California, Berkeley; VERA SERGANOVA, University of California, Berkeley; ROBERT F. ALMGREN, University of Chicago; OSCAR P. BRUNO, Georgia Institute of Technology; NIGEL BOSTON, University of Illinois at Urbana-Champaign; LIHE WANG, University of Iowa; SCOTT AXELROD, Massachusetts Institute of Technology; ALAN EDELMAN, Massachusetts Institute of Technology; CHUN-NIP LEE, Northwestern University; MICHAEL LARSEN, University of Pennsylvania; XIAO-JING WANG, University of Pittsburgh; SAI KEE YEUNG, Purdue University; RICHARD A. STRONG, Rice University; JUN LI, Stanford University; JOSE FELIPE VOLOCH, University of Texas at Austin; AARON BERTRAM, University of Utah; MARK A. LEWIS, University of Utah; HART F. SMITH, University of Washington; CLAUDIA NEUHAUSER, University of Wisconsin; and JAY JORGENSON, Yale University.

The review committee making the fellowship selections in mathematics consisted of Spencer J. Bloch, University of Chicago; William P. Thurston, Mathematical Sciences Research Institute; and Karen K. Uhlenbeck, University of Texas at Austin.

AWM Hay Award

The 1994 Louise Hay Award for Contributions to Mathematics Education has been presented to KAYE A. DE RUIZ of the United States Air Force Academy. The award, sponsored by the Association for Women in Mathematics (AWM), was presented at the Joint Mathematics Meetings in Cincinnati in January 1994.

de Ruiz completed a master of science in college administration, with a minor in statistics, at Oregon State University. She attended Officer Training School and became a second lieutenant in the Air Force. In 1990 she received her doctorate in applied statistics from the University of California at Riverside. "Dr. de Ruiz is a skilled teacher, a respected researcher, a very capable administrator, and a wonderful role model," the citation for the award says. "She has enjoyed a career filled with wide-ranging contributions to the mathematical education of an extraordinarily diverse population of students."

de Ruiz began her teaching career at Roseburg High School in Roseburg, Oregon, where she developed and implemented a team-teaching approach to geometry. She spent two years at Misawa Air Force Base in Japan and in 1982 began teaching full time at the Air Force Academy. She was the course director for differential calculus, the largest mathematics course at the Academy. The citation calls de Ruiz "sensitive and responsive to the diverse needs of the more than 700 first-year cadets and their fifteen instructors." Later she also taught probability and statistics and incorporated "real world" problems into her courses. After taking time off to complete her Ph.D., she "wasted no time in applying her new skills to improving the statistics courses at the Academy," the citation says. As chief of the statistics division, she adopted new textbooks, revised curricula to include computer packages, wrote a workbook to assist professors in incorporating technology into their statistics courses, and contributed to a textbook on basic statistics. de Ruiz also serves as a consultant to other departments and agencies outside the Academy.

The purpose of the Louise Hay Award is to recognize outstanding achievements in any area of mathematics education. Louise Hay was widely recognized for her contributions to mathematical logic and for her strong leadership as head of the Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago. In addition, her devotion to students and her lifelong commitment to nurturing the talent of young women and men secure her reputation of a consummate educator. The annual presentation of the Hay Award is, according to the AWM, "intended to highlight the importance of mathematics education and to evoke the memory of all that Hay exemplified as a teacher, scholar, administrator, and human being."

Phi Beta Kappa Visiting Scholars for 1994-1995

Phi Beta Kappa has announced the appointment of thirteen Visiting Scholars for 1994–1995. The Visiting Scholars travel to universities and colleges with Phi Beta Kappa chapters, spending two days on each campus. During each visit the scholar is expected to meet with undergraduates on a more or less informal footing, to participate in classroom

lectures and seminars, and to give one major address open to the entire academic community.

Two of the Visiting Scholars work in the mathematical sciences: MICHAEL FISHER, Wilson H. Elkins Distinguished Professor at the Institute for Physical Science and Technology at the University of Maryland; and VERA PLESS, professor of mathematics at the University of Illinois at Chicago.

Kenneth Ross Elected Next MAA President

Kenneth A. Ross of the University of Oregon has been elected president of the Mathematical Association of America (MAA) to serve a two-year term beginning January 1, 1995. Ross served for many years as associate secretary for the Western Section of the AMS and is currently associate secretary for the MAA. Currently, Donald Kreider of Dartmouth College is president of the MAA.

Presidents of European Mathematics Organizations

Heinz W. Engl of Johannes Kepler University in Linz, Austria, has been elected president of the European Consortium for Mathematics in Industry (ECMI) for a two- and one-half-year term which started in January of this year. ECMI is one of the sponsoring societies of the International Congresses of Industrial and Applied Mathematics.

Currently, Friedrich Hirzebruch of the Max Planck Institute for Mathematics in Bonn is president of the European Mathematical Society (EMS). His term ends this year. Elections will take place at the EMS Council meeting after the International Congress of Mathematicians in Zurich in August of this year.

Elections to the Engineering Academy

The National Academy of Engineering announced the election of seventy-nine new members and eight foreign associates. Among those elected were two mathematical scientists, STEPHEN H. DAVIS of Northwestern University and BRUCE A. FINLAYSON of the University of Washington.

Mathematical Modeling Contest Winners Announced

The Consortium for Mathematics and its Applications (COMAP) has announced the winners of the Tenth Annual Mathematical Contest in Modeling. A national panel of judges, including representatives from the Operations Research Society of America (ORSA) and the Society for Industrial and Applied Mathematics (SIAM), have chosen six outstanding teams: Beloit College, Grinnell College, North Carolina School of Science and Mathematics, University of Calgary, University of North Carolina at Chapel Hill, and University of Toronto. ORSA designated Grinnell College and the University of Toronto as the winning teams for their prize, while SIAM chose the North Carolina School for Science and Mathematics and the University of North Carolina as their winners.

All winning teams receive bronze plaques and memberships in COMAP. The SIAM winning teams receive a cash prize, and the team members receive all-expense paid trips to the SIAM Annual Meeting in San Diego this summer. The ORSA winning teams also receive free trips to that organization's meeting this summer in Boston.

The 1994 contest had 315 teams representing 198 schools in ten countries: Bulgaria, Canada, China, Hong Kong, Ireland, Latvia, Lithuania, South Africa, the United States, and Zimbabwe. Participation of women students in the contest was high; 82% of the teams participating had at least one female team member, and eleven teams were all female. The contest lasted four days, over the weekend of February 18 to 21, 1994. The teams, up to three undergraduates, were asked to research and find a solution to one of two open-ended modeling problems.

This year, one of the problems was to analyze the temperature variation of a concrete slab floor to determine if the temperature average can be maintained within a prescribed comfort zone throughout the year. The second problem was to find an optimal schedule and the minimal total time for scheduling transfers of information for a given company's communications network as the network changed and expanded.

For more information about the contest and instructions on how to enter a team in the 1995 contest, write to: COMAP, Inc., Suite 210, 57 Bedford Street, Lexington, MA 02173; telephone 617-862-7878; fax 617-863-1202.

Mathematics Project Places Fourth in Westinghouse Competition

A high school student submitting a mathematics project placed fourth in the Westinghouse Science Talent Search, the nation's oldest high school science competition. Since its inception by Science Service in 1942, the Westinghouse Science Talent Serach has hosted 2,120 finalists, five of whom have won Nobel Prizes, two of whom have won Fields Medals, and nine of whom have received MacArthur Foundation Fellowships.

The fourth place scholarship of $15,000 went to ROBERT CHRISTOPHER SARVIS of Alexandria, Virginia, a student at the Thomas Jefferson High School for Science and Technology. Sarvis's project studied a specifically defined tree in certain lattices. The project could contribute to solving problems in such areas as microchip design, fractal geometry, chemistry, and crystal growth.

Ten students were selected for top honors in the competition, with first place carrying a $40,000 scholarship. Two alternates and twenty-eight other finalists were awarded scholarships of $1,000 each, bringing the total value of all the awards to $205,000. The winners were announced at an awards banquet at the Mayflower Hotel in Washington, DC. The competition began last fall when 1,645 high school seniors submitted independent research projects to Science Service. A board of leading scientists selected the forty finalists who attended the five-day program in Washington.

Science Service, Inc., is a nonprofit corporation dedicated to advancing public understanding of science, especially among youth and members of underrepresented groups. Science Service also sponsors the International Science and Engineering Fair, which brings together nearly 900 of the world's top students from North America, Europe, Asia, and South America.

News from the Isaac Newton Institute

From January until June 1995, a major program in financial mathematics will be held at the Isaac Newton Institute for Mathematical Sciences in Cambridge, England. The program will comprise visits by many leading academics from the various subjects currently involved in the theory and practice of finance, as well as visits by interested practitioners.

The program will begin in January with an introductory meeting of one week's duration, the first half of which will be aimed at presenting to a general audience some of the problems and techniques already tackled in financial theory and application, and the second half of which will seek to define a number of areas of outstanding open interest and to review progress in those areas. During a week around Easter, Sam Howison will lead a practitioners' workshop, where experienced practitioners will be invited to discuss with the academic visitors at the Newton Institute very concrete problems in finance. Toward the end of the program, a major international meeting is planned, which will run about ten days and will be of a more conventional format.

The most unusual and exciting feature of the programs is that, for a prolonged period, many of the world's top people in the subject will gather and interact to discuss and hopefully solve problems and to generally advance understanding of the whole area.

At different times during the six months, different topics will be given special emphasis, depending on who is at the Institute at the time. However, there will be special emphasis periods in the following broad areas: Pricing and Hedging of Derivatives, Term Structure Modeling, Econometrics/Empirical Studies, Numerical Methods and PDE, Optimal Portfolio/Consumption Problems, General Equilibrium Theory, and Abstract Continuous-time Theory.

Those expected to attend include: P. Artzner (Strasbourg), K. Back (St. Louis), A. Bensoussan (INRIA, Rocquencourt), M. Brennan (UCLA), I. Cooper (LBS), J. C. Cox (MIT), J. Cvitanic (Columbia), M. H. A. Davis (Imperial), F. Delbaen (Brussels), M. A. H. Dempster (Essex), J. Detemple (Columbia), D. Duffie (Stanford), P. Dybvig (St. Louis), E. Eberlein (Freiburg), R. J. Elliott (Alberta), P. Embrechts (ETH Zürich), L. Foldes (LSE), H. Föllmer (Bonn), H. Geman (ESSEC), F. Hahn (Cambridge), A. Harvey (LSE), D. Heath (Cornell), S. D. Hodges (Warwick), S. Howison (Oxford), L. P. Hughston (Merrill Lynch), S. Jacka (Warwick), F. Jamshidian (Fuji International Finance), I. Karatzas (Columbia), P. E. Kopp (Hull), J. Lehoczky (Carnegie Mellon), A. Lo (MIT), W. Perraudin (Cambridge), S. Pliska (Chicago), L. C. G. Rogers (QMW), S. A. Ross (Yale), H. Richardson (Motron, Inc.), W. Runggaldier (Padova), W. Schachermeyer (Vienna), E. Schwartz (UCLA), S. Shreve (Carnegie Mellon), J. Steeley (Keele), S. Sundaresan (Columbia), S. Taylor (Lancaster), W. Willinger (Bellcore), P. Willmott (Imperial), T. Zariphopoulou (Madison), and W. Ziemba.

For more information about this program, contact: L. C. G. Rogers, School of Mathematical Sciences, Bath University, Claverton Dwon, Bath BA2 7AY, United Kingdom; telephone 225-826224; fax 225-826492; e-mail `lcgr@maths.bath.ac.uk`. For general information about the Newton Institute, contact the Deputy Director, Peter Goddard, 20 Clarkson Road, Cambridge, CB3 0EH, United Kingdom; telephone 22 223-335999; fax 223-330508; e-mail `i.newton@newton.cam.ac.uk`.

Report on Women in the Sciences

Wellesley College has issued a major report on the representation and retention of women in the sciences. Entitled "Pathways for Women in the Sciences", the report presents results from a longitudinal study of the issue of women's participation and persistence in science. The study looked into the experiences and aspirations of Wellesley students and alumnae during their undergraduate, graduate, and early career years. Although the focus is on women students, the report explores many issues relevant to the education of all students.

Unlike many reports of this type, this one manages to maintain throughout a lively balance of data, analysis, and anecdote. A number of sidebars provide short personal histories of individual women participating in the study, providing a glimpse at the stories hidden in the bar graphs and pie charts. Only Wellesley students participated in the Pathways study, but the report does weave in results from other studies and provides a substantial bibliography of the literature on this subject.

One of the key findings of the report is that those who persist in science developed an interest in the subject before coming to college. For some questions, the study grouped students in four different tracks: Nonscience, Science, Switchers, and Joiners. "Switchers" were those who switched out of science after initially indicating interest in it, and "Joiners" were those who came to science after initially expressing little interest in it. Twenty-one% of students switched out of science after two years, but only 3% joined.

The report notes that the students who choose not to major in science usually do so because they find other areas that are more interesting, not because they dislike science. (However, the second most common reason given for not majoring in science was not liking mathematics.) In addition, some common perceptions about attitudes toward science were not borne out in the study. "Even those who did not name mathematics or science as their favorite subjects in high school were willing to concede that they are interesting and creative fields; only 12% said they were not," the report states. "They were equally unwilling to label these as 'male' fields, a haven for 'nerdy' people, or a route incompatible with having a family. However, 36% strongly agreed and another 50% somewhat agreed that science and mathematics demand a special calling." The latter finding indicates that "some students may rule out careers in these fields despite a reasonable level of aptitude and interest."

Those who pursued and persisted in science showed a strong preference for subjects with precise answers rather than subjects in which multiple interpretations are possible: 73% of science majors indicated such a preference, while only 19% of nonscience majors did.

In addition, the report notes that previous studies found a connection between women majoring in science and having a father who is in science. The Pathways study found that among science majors 46% had fathers who were in science, compared to 35% for nonscience majors; the percentage rose to 52% for nonscience premed students. Those who persisted in science were more likely to have had encouragement from multiple sources (including mothers, fathers, and teachers) than were nonscience majors. Only 43% of science majors felt that "society" encouraged women to pursue science. Although encouragement was important, the students overwhelmingly reported that interest in the subject was the most important factor in choosing a major. Having had an undergraduate experience in research also appeared to be an important factor stimulating and maintaining many of the students' interest in science.

The difficulty of combining career and family is an issue that many young women in college face. The Pathways study found that over 90% of the women in the study expected to have children during the next ten years, and 90% thought a woman should only work part-time or not at all if she has an infant. In addition, the respondents worried about how to manage the demands of caring for a child with the demands of a career in science. "My male peers do not and will not worry about this, since their wives are generally less educated and will take child care responsibilities," said one respondent, who works in the medical field. Although her husband would help with child care, she said, "I will be the one, I know, to compromise both my career and the care that I can personally give to my children. Choice is a meaningless word in this society." A woman working in mathematics had this to say: "Raising children is a science if you take it seriously. Don't forget that child care *is* a career for some people, but somehow it is not a career for the parent. Figure that one out!"

The report also looks at sexual harassment and discrimination. Those in medical school reported more incidents of both than did those in graduate school in science, but even there the figures were still "disturbingly high", the report notes: about 25% reported that they had been sexually harassed, and about 35% reported that they had been victims of sexual discrimination. On the other hand, it appeared that few woman allowed these problems to interfere with their aspirations. "These women felt they had put a great deal into their studies and work and were not going to give up easily or change pathways," the report states. "Moreover, a number of alumnae spoke directly of fighting back and gaining empowerment through being resilient."

The next stage of the Pathways study has begun, in which the longitudinal study will continue and the research on work and family issues will be expanded. The report concludes with a number of questions for the next stage of the study as well as a number of suggestions for future research and policy. Copies of the 177-page report are available for $20 (including postage and handling) from: Center for Research on Women, Publications Department, Wellesley College, Wellesley, MA 02181-8259; telephone 617-283-2500.

News from the Institute for Mathematics and its Applications

University of Minnesota

The IMA 1994–1995 academic year program is **Waves and Scattering**. The program coordinators are George Papanicolaou (chair), Ingrid Daubechies, William Symes, Jeffrey Rauch, Bjorn Engquist, and Barry Simon. The year is divided into three parts (corresponding to fall, winter, and spring quarters), although it is expected that there will be considerable fluidity between the various parts.

Fall, September 9–December 30, 1994: Theory and computation for wave propagation

Winter, January 2–March 31, 1995: Inverse problems in wave propagation

Spring, April 1–June 30, 1995: Singularities, oscillations, quasiclassical and multiparticle problems

The fall program will begin with a tutorial on **Computational Wave Propagation**, September 7–9, 1994, with R. Burridge, B. Engquist, L. Halpern, and G. Kriegsmann as speakers. On September 19–23, 1994, will be held the workshop **Computational Wave Propagation**, organized by B. Engquist and G. Kriegsmann. On October 11–13, 1994, there will be a tutorial on **Wavelets, Multigrid and Other Fast Algorithms**, with I. Daubechies, B. Fornberg, S. Mallat, and S. McCormick as speakers. This will be followed by the workshop **Wavelets, Multigrid and Other Fast Algorithms (Multipole, FFT) and Their Use in Wave Propagation**, organized by G. Beylkin, I. Daubechies, and G. Papanicolaou. The last major programming of the fall term will be the November 9–10, 1994, tutorial on **Waves in Random and Other Complex Media**, with speakers R. Burridge, G. Papanicolaou, L. Pastur, and B. White, followed by the workshop **Waves in Random and Other Complex Media**, November 14–18, 1994, organized by R. Burridge and G. Papanicolaou.

For more information about IMA activities, see the "Meetings and Conferences" section of this issue of the *Notices* or contact the IMA (`ima-staff@ima.umn.edu`). Also, weekly IMA seminar schedules with titles and abstracts are available on Usenet: **umn.math.dept** and by fingering `seminar@ima.umn.edu`, and TEX files for the *Newsletter* and the *Update* are available via anonymous ftp (at `ftp.ima.umn.edu`) or gopher (at `gopher.ima.umn.edu`).

News from the Mathematical Sciences Institute

Cornell University, University of Puerto Rico, and SUNY Stony Brook

The Center for Analysis of Nonlinear Systems at Stony Brook will host the Fifth International Conference on Hyperbolic Problems Theory, Numerics, Applications, June 13–17, 1994. On Sunday, June 12, preceding the conference, there will be workshops and tutorials on "Industrial Mathematics and Parallel Computing". The program will include plenary lectures, invited and contributed talks, and poster sessions. The conference has as its intellectual center the subject of conservation laws. The program will include sessions on:

1. Mathematical theory of hyperbolic conservation law: admissibility criteria, existence and uniqueness, large time asymptotics, relaxation methods, Riemann solutions.

2. Computation of solutions of hyperbolic equations: adaptive numerical methods, enhanced resolution numerical methods, shock-capturing methods.

3. Applications including elastic and plastic flows, flow in porous media, flows in granular materials, image processing, relativity, semiconductor manufacture, turbulent mixing.

The invited speakers include: Mathematical Theory: F. Asakura, G.-Q. Chen, D. Christadoulou (Plenary), X. Ding, A. Donato, H. Freistuhler, J. Greenberg, D. Hoff, L. Hsiao, B. Keyfitz, P. Marcati, D. Marchesin, T.-P. Liu (Plenary), A. Needleman, B. Plohr (Plenary), D. Serre, J. Smoller (Plenary), B. Temple, Z. Xin, R. Young, T. Zhang, K. Zumbrun; Computation: G. Baker (Plenary), M. Berger, P. Colella (Plenary), B. Engquist (Plenary), A. Harten, R. Jeltsch (Plenary), C. Johnson, R. LeVeque, B. Perthome, P. Roe (Plenary), A. Szepessy, B. van Leer; Applications: R. Devore, J. Grove, J. Jaffre, J.-M. Morel, P. Ortoleva, S. Osher (Plenary), N. Reisbro, D. Ross, D. Schaeffer (Plenary), M. Slemrod, T. Wright.

For more information please contact: HYP-94, Conference Secretary, Department of Applied Mathematics, SUNY at Stony Brook, Stony Brook, NY 11794-3600; telephone 516-632-7566; fax 516-632-8490; e-mail: `hyp94@ams.sunysb.edu`.

October 28–30, 1994, MSI at Cornell will sponsor a workshop on "Hybrid Systems and Autonomous Control". Hybrid systems are interacting networks of digital and continuous devices. Typically they occur in digital control systems, in business, industry, and the military. In that context, the fundamental problems are: extraction of digital control programs from systems equations and performance specifications, and formal verification and statistical testing that digital control programs enforce the system performance specification.

The field is rapidly advancing in theory and applications and is at the interface of computer science, control engineering, and mixed dynamical systems. The program committee, all of whom have contributed strongly to this area, will form a core of lectures for the workshop. The final results of the workshop will be a sequel to *Hybrid Systems* (R. Grossman, A. Nerode, H. Rischel, A. Ravn, Editors) LNCS 736, 1993, consisting of a cross section of invited research papers. There will be both plenary lectures, twenty-minute sessions, and evening poster sessions. Contributions are invited for twenty-minute session papers and poster sessions. There will be further invited one-hour lectures arranged by the Program Committee. 1,500-word abstracts of papers proposed for presentation at this workshop are due by May 16, 1994. Send the abstracts to MSI, Attn: A. Nerode.

Participation is limited to 150, due to space limitation at Cornell. Subventions will be available for a limited number of those graduate students and postdocs whose papers are accepted for either the twenty-minute or poster sessions.

The registration fee will be $95 for nonstudents, $40 for students. Registration packets may be obtained from: Valerie Kaine, Mathematical Sciences Institute, 409 College Avenue, Ithaca, NY 14850; telephone 607-255-8005; e-mail `vdk1@cornell.edu`.

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

The MSI Center for Stochastic Analysis at Cornell will hold a meeting at MSI on January 15–17, 1995, on "Random Partial Differential Equations". The very general subject will be partial differential equations in which something is random. Different methods of introducing the randomness lead to quite different problems. In arranging this meeting, however, organizers are hoping for a useful exchange of information between people familiar with different ends of this elephant. The list of invited speakers given below is intended to represent a number of different viewpoints. The invited speakers include: R. Carmona (UC Irvine), D. Dawson (Carleton U.), J. Glimm (Stony Brook), A. Majda (Princeton), C. Mueller (Rochester), G. Papanicolaou (Stanford), E. Perkins (U. of British Columbia), D. Sharp (Los Alamos), B. White (Exxon), H.T. Yau (Courant), Q. Zhang (Stony Brook).

Peter Antal, a student of Alain Sznitman at ETH in Zurich has been appointed to a two-year postdoc at the Center for Stochastic Analysis. Itai Benjamini, who has been a postdoc for two years, will continue for another year, spending half of his time at Cornell and the other half in Berkeley and Israel.

Funding Information for the Mathematical Sciences

CAREER Program at NSF

The National Science Foundation (NSF) has repackaged a number of existing programs under a new program called Faculty Early Career Development (CAREER). This is described in the following "Dear Colleague" letter from the NSF's Margaret Cavanaugh of the directorate for Mathematical and Physical Sciences (MPS).

"Dear Colleague:

"On March 18, the National Science Board approved a Foundation-wide program for Faculty Early Career Development (CAREER). Tenure-track faculty within four years of their first faculty appointment are eligible to apply for three to five years of support for their formative research and education efforts. The purpose of the program is to encourage holistic career development among new faculty, in which they establish their own patterns for development as scholars in the full sense of the word.

"Applicants will be required to submit a fifteen-page proposal, following the GPG [Grants and Proposal Guide] guidelines. The proposal itself, however, will consist of a Career Plan—endorsed by the department chair—with ten pages devoted to a research proposal and five pages to plans for education efforts. In effect, NSF will be entering into a partnership with academic institutions to assist them in the career development of new faculty members, as appropriate for the mission of each institution.

"Guidelines for award size and duration, the merit review process, and the distribution of resources between junior and experienced faculty will be set at the directorate or division level. An annual report on the results of the program will include a discussion of the funding of individuals from underrepresented groups.

"A number of programs have been subsumed into the CAREER program. Commitments will be met for continuing grant increments for current grantees, but no new proposals will be accepted in fiscal year 1995 for NSF Young Investigators [NYI], Research Initiation Awards (CISE [Computer and Information Science and Engineering] and ENG [Engineering]), or Minority Research Initiation [MRI] Awards. (Please note carefully: the MRI Planning Grant and Career Advancement Award programs are *not* affected.) For a smooth financial transition, indirect costs on CAREER awards made in fiscal year 1995 will be 10%; in FY96, 20%; and thereafter, normal institutional rates. Matching funds are not required. CAREER proposals and regular proposals for the same research will not be considered simultaneously, but concurrent or prior federal support does not preclude eligibility unless the award was a PYI [Presidential Young Investigators], NYI, or PFF [Presidential Faculty Fellows]. While transitions are always time-consuming, the long-term impact of these changes on program management is expected to be positive.

"The members of the CAREER Coordinating Committee (CCC) are listed below. The Committee is working to issue a program announcement as quickly as possible, so that it will appear in a timely way for the deadlines many directorates favor. The Committee will keep you informed as this progresses. Also planned for the summer are information sessions for program officers about the program and details of implementation for each directorate. If you have questions before that, please contact a member of the CCC.

Margaret Cavanaugh, MPS, chair
Tom Brady (Joanne Hazlett, alternate), BIO
Noel Broadbent, OPP
John Cherniavsky, CISE
Marv Kauffman, GEO
Sue Kemnitzer (Linton Salmon, alternate), ENG
Barbara Lovitts, EHR
Bonney Sheahan, SBE"

The mailing address for the NSF is: National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

Fulbright Teacher Exchange Program

The Fulbright Teacher Exchange Program, conducted by the United States Information Agency, is open to elementary through university level educators (both teachers and administrators). The program involves direct, one-for-one exchanges in which both teachers secure leaves of absence with salary from their home institutions and then trade classes for the year. More than thirty-five countries in Europe, Africa, and South and Central America participate in the program.

The general eligibility requirements are: U.S. citizenship; fluency in English; bachelor's degree or higher; three years of full-time teaching experience; and a current full-time teaching or administrative position. Some countries also require fluency in the native language. Exchange grants may include full or partial travel grants and cost of living supplements, depending on the country.

The application deadline is **October 15, 1994**. Applicants from abroad should inquire at the U.S. Embassy, USIS section. Requests for application booklets and general information should be directed to: Fulbright Teacher Exchange Program, Attn: NSL, 600 Maryland Avenue, SW, Room 235, Washington, DC 20024-2520; telephone 800-726-0479.

NSF Grant Proposal Guide and Proposal Form Kit

The National Science Foundation (NSF) has developed an NSF Proposal Forms Kit to: 1) standardize and streamline the proposal preparation process as well as ease the burden on reviewers; 2) develop a parallel computerized version of the kit to facilitate electronic proposal submission; 3) provide a proposal forms kit for NSF that also could be used by other science agencies.

The new proposal forms kit is contained in the NSF Grant Proposal Guide (GPG). This document replaces the "Grants for Research and Education in Science and Engineering" (GRESE) (NSF 92-89).

The GPG will be effective for all proposals submitted on or after Monday, April 4, 1994. After that date, all versions of the GRESE and its forms should be discarded. The NSF Grant Policy Manual will be revised to reflect these changes.

Copies of the new GPG are available from the Forms and Publications Unit, Room P15, 4201 Wilson Boulevard, Arlington, VA 22230; e-mail `pubs@nsf.gov` (Internet) or `pubs@nsf` (Bitnet). Be sure to specify the document number NSF 94-2, your mailing address, and how many copies you need. In addition, the new GPG is available through STIS, the NSF's online information service. You can access STIS by connecting via telnet to `stis.nsf.gov` and using the login name "public". For further information on how to use STIS, send a message to `stis@nsf.gov` (Internet) or `stis@nsf` (Bitnet).

Funding for Workshops in Econometrics and Statistics

The Economics Program and the Statistics and Probability Program at the National Science Foundation support conferences, workshops, seminars, or other institute-like activities in econometrics and statistics with an emphasis on substantive applications.

August 15, 1994, is the target date for a special competition for institute-like activities in econometrics and statistics. The plan is to make at least two grants for $75,000 per year for three years for each grant. The proposals selected will be those that, based on peer review, are likely to have the greatest scientific impact on econometrics and statistics. The emphasis in this competition will be on linking research at the frontiers of econometrics and statistics to substantive applications in economics. The institute-like activities need not take place exclusively at one institution but can involve a consortium of research institutions. There is no special format and there are no requirements beyond those described in the Grant Proposal Guide (see accompanying news item about the new Grant Proposal Guide).

For more information, contact Daniel H. Newlon in the Economics Program, telephone 703-306-1753; or Alan J. Izenman in the Statistics and Probability Program, telephone 703-306-1884, e-mail `aizenman@nsf.gov`.

New NSF Initiative in Undergraduate Mathematics Education

The following "Dear Colleague" letter describes a new initiative of the National Science Foundation (NSF). Further information about the initiative follows the letter. Also see the related article in this issue of the *Notices*, "New Mathematical Sciences Curriculum Initiative at the NSF".

Dear Colleague Letter

"Dear Colleague:

"I am writing to inform you of a new National Science Foundation initiative in undergraduate education: Mathematical Sciences and Their Applications Throughout the Curriculum.

"The purpose of the initiative is to promote systemic improvements in undergraduate education by increasing student understanding of and ability to use the mathematical sciences. The projects will require collaboration of faculty in the mathematical sciences with faculty in other disciplines, and full support of the participating academic units. The funded projects are expected to result in national models of undergraduate curricula and instructional approaches that will have a profound impact on the participating and adopting institutions. Coalitions of institutions, which may include two- and four-year colleges and universities, are especially encouraged to apply.

"The initiative will begin in fiscal year 1994 with the award of 10–20 planning grants. The closing date for planning grant proposals is **June 6, 1994**. It is anticipated that these planning grants will provide a basis for the preparation of comprehensive proposals that will lead to a few awards of up to $1 million per year for 3–5 years. Proposals for fully developed projects will be due **February 6, 1995**. Although it is anticipated that the most competitive proposals will be submitted by institutions receiving planning grants, institutions will not be required to have received a planning grant to submit a full proposal.

"The [following] document is an extension of the Course and Curriculum Development (CCD) Program administered within the Division of Undergraduate Education (DUE). Other NSF units will participate with DUE in this effort. Key individuals in DUE coordinating this initiative are Robert F. Watson, Division Director; James Lightbourne, Tina Straley, and Elizabeth Teles, Program Directors; and Herbert Levitan, CCD Section Head (703-306-1669).

"I am very pleased that NSF can offer this initiative to provide further support in the effort to systemically improve undergraduate education in our nation's colleges and universities. I encourage you to consider this initiative for your institution and to share this information with other individuals as you think appropriate. In addition to faculty and department heads, this initiative should be of particular interest to individuals who head a division or college within an institution, academic units which include several disciplines.

"Sincerely,

Luther S. Williams

Assistant Director, Education and Human Resources"

Additional Information

The mathematical sciences are essential in undergraduate education for virtually all students, including those preparing to be scientists, engineers, technicians, teachers, leaders in business and government, and, more generally, scientifically literate citizens. The ability of students to succeed as they prepare for and enter our increasingly technologically oriented workforce is fundamentally dependent on their understanding of mathematics and especially its application in practical situations. This initiative is part of the NSF's strategy to promote comprehensive and systemic reform of undergraduate science, mathematics, engineering, and technology education.

The purpose of this special initiative is to promote comprehensive improvements in undergraduate education that lead to increased student understanding of and ability to use the mathematical sciences. The projects supported through this initiative are expected to serve as national models for better integrating the mathematical sciences into other disciplines and improving instruction in the mathematical sciences through incorporation of other disciplinary perspectives. Projects are expected to involve a critical mass of faculty in the mathematical sciences in full partnership with faculty in other disciplines. Proposals must demonstrate the support of the participating academic units and of the institution's leadership.

This initiative is a special thrust of the Course and Curriculum Development (CCD) Program offered by the Directorate for Education and Human Resource's Division of Undergraduate Education (DUE). To continue the progress that has been made to revitalize undergraduate education through such efforts as calculus reform, projects should result in the development and adaptation of innovative approaches as well as their large scale implementation. Exciting and successful innovations are emerging: courses are being reinvigorated through changes in content; student learning is being improved through more effective instructional practices and the use of computational technologies; and faculty and institutions are discovering ways to increase the diversity of students who are attracted to and successful in disciplines requiring a foundation in the mathematical sciences. Projects supported by this new initiative are expected to result in institutional change through the pervasive implementation of these and other innovations. A coordinated effort, involving the mathematical sciences and other disciplines, will be required.

Proposals are sought from single institutions or coalitions of institutions, which may include two- and four-year colleges and universities. The Foundation's role is to help initiate these major efforts, with the support from the institutions phased in to assure permanence of the reform. Planning grants of up to $50,000 will be awarded to develop the full project proposals. A small number of comprehensive projects will receive awards of up to $1 million dollars per year for three to five years.

The interdisciplinary characteristic of this initiative is central and particularly challenging and will require development by a multidisciplinary project team and strong support across academic units. Examples that illustrate a few approaches on which the interdisciplinary aspects of a project might be based include:

- development of lower and upper division courses that integrate topics from science or engineering, together with the mathematical sciences, and are created and taught by multidisciplinary teams;
- development of modules which are used to incorporate concepts and topics from the mathematical sciences in other disciplines and perspectives from other disciplines in the mathematical sciences;
- the incorporation of mathematical modeling and visualization through computer graphics into science, engineering, and mathematical sciences curricula.

In summary, projects should:

- have the faculty and the institutional support that is necessary for systemic and lasting impact;
- involve close cooperation of faculty in the mathematical sciences with faculty in other disciplines, including, for example, multidisciplinary project teams and multidisciplinary representation among the coprincipal investigators;
- adapt or develop curricula and instructional approaches that will enable students to gain an understanding of and ability to use the mathematical sciences in their chosen undergraduate studies;
- increase the diversity of students who are attracted to and successful in disciplines requiring a foundation in the mathematical sciences;
- build on and continue recent progress made in educational reform;
- provide for the development of faculty and training of graduate students (for those institutions with graduate programs) to improve implementation of effective approaches for teaching, learning, and applying the mathematical sciences;
- develop instructional materials, such as textbooks, course modules, lab manuals, and software;
- contain an evaluation component that will determine how effectively the project is achieving its goals;
- provide dissemination that will facilitate widespread adaptability and increase adoption of the approaches and products developed in the project.

Proposals for planning grants requesting up to $50,000 for up to one year should follow the general guidelines for the CCD program (see the DUE Program Announcement, NSF 93-164). Specifically, proposals for planning grants should include a cover page (NSF-1207); the Project Data and Summary Form (NSF-1295); an estimated budget for the planning grant; a budget justification; a list of faculty, departments, and institutions involved; vitae for the key faculty; and a narrative of five double-spaced pages or less. The narrative should describe the broad vision and the essential features of the ultimate project. It is expected that the majority of the costs in the planning proposals will be for personnel. Ten copies of the proposal should be submitted, postmarked no later than **June 6, 1994**, to: National Science Foundation, Attn: EHR/DUE - CCD - MATH,

Department N-BioS, Announcement No. 93-164, 11200 Rockville Pike, Suite 300, Rockville, MD 20852.

Review of proposals for planning grants will be completed in July, 1994. Although it is anticipated that the most competitive proposals will come from institutions holding planning grants, an institution is not required to have received a planning grant in order to submit a full proposal. The full proposals will be due **February 6, 1995**.

This initiative is an extension of the CCD program. Proposals for projects that do not have the interdisciplinary or other features expected in this initiative should continue to be submitted to the regular CCD Program or other appropriate NSF program.

Key individuals in DUE coordinating this initiative are: Robert F. Watson, `rwatson@nsf.gov`; James Lightbourne, `jhlightb@nsf.gov`; Tina Straley, `tstraley@nsf.gov`; Elizabeth Teles, `eteles@nsf.gov`; and Herbert Levitan, `hlevitan@nsf.gov`. The telephone number is 703-306-1669. Two program officers from the Division of Mathematical Sciences are also involved: Lloyd Douglas, `ldouglas@nsf.gov`, 703-306-1874; and Deborah Lockhart, `dlockhar@nsf.gov`, telephone 703-306-1882. (The e-mail addresses above are Internet addresses; for Bitnet, replace `@nsf.gov` with `@nsf`). The mailing address is: Division of Undergraduate Education, Directorate for Education and Human Resources, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

To obtain copies of the publications noted above, write to: Forms and Publications Unit, Room P15, at the street address above. The e-mail address is `pubs@nsf.gov` (Internet) or `pubs@nsf` (Bitnet). Be sure to specify the document number, your mailing address, and how many copies you need. In addition, documents are available through STIS, the NSF's online information service. You can access STIS by connecting via telnet to `stis.nsf.gov` and using the login name "public". For further information on how to use STIS, send a message to `stis@nsf.gov` (Internet) or `stis@nsf` (Bitnet).

For Your Information

How to Use Strategic Reports: Practical Pointers

The following article was written by John R. Tucker, Senior Program Officer for the Board on Mathematical Sciences and the Committee on Applied and Theoretical Statistics of the National Research Council. A version of the article originally appeared in *Amstat News*, Number 207, March 1994.

The Board on Mathematical Sciences (BMS) and the Committee on Applied and Theoretical Statistics (CATS) of the National Research Council have produced a number of strategic reports designed to enrich the research, educational, and professional activities of college and university mathematical sciences and statistics departments. Recent examples include [9, 8, 10, 13, 12, 17, 15, 18, and 16]. Books and reports on mathematical sciences and molecular biology, group theory, statistics education, medical imaging, and other areas will be published within the next twelve months.

At the Annual Department Chairs Colloquium on October 30, 1993, BMS Director John Lavery moderated a panel session on how departments can use these strategic reports to improve their competitive positions inside the university. The panelists were James Glimm, who chairs the Department of Applied Mathematics and Statistics at the State University of New York at Stony Brook, and past CATS chair William F. Eddy, professor of statistics at Carnegie Mellon University.

To open the session, Lavery described the objective: mathematical sciences and statistics departments must take a strong leadership role within the university; strategic reports can be used to find ways a department can add value in areas that involve the mathematical sciences and statistics. He noted four themes for how to create success: concentrate in one or a few areas, get a critical mass within the department, recognize and reward people who create linkages (or who do related beneficial activities), and acknowledge that there is a customer to whose benefit these efforts must be directed.

Glimm stressed that chairs and faculty leaders in university departments must themselves learn, understand, and communicate the importance of the mathematical sciences and statistics in our modern technological society, and stimulate their faculty to communicate this importance. Department faculty should be encouraged to join in activities with people from other departments and disciplines, to build partnerships within the university, and to lead in breaking new ground. He mentioned what effect the citing to the dean of just one sentence from a report had in gaining released time for newly hired faculty and gave another example where the report "Computational Modeling and Mathematics Applied to the Physical Sciences" [3] was used as a "how to" guide in setting up a departmental computing facility. He believes that the "zero-ten" law operates in these matters: zero people will want to work on a bad idea, and for a good idea, ten people will want to do it.

Glimm saw the department's customers as including students, faculty, other departments and their chairs, deans and provosts, government agencies, and industry. He said that the idea of how those customers are served by the department must be enlarged beyond the mere offering of service courses. Referring to the reports "Mathematical Sciences, Technology, and Economic Competitiveness" [9] and "The Mathematical and Computational Sciences in Emerging Manufacturing Technologies and Management Practices" [1], he observed that "we educate ourselves with such reports, as well as other sectors." He did not recommend reading all of these many reports, but rather skimming them and going into the details of those in which one has interest.

Glimm gave examples of how the reports can be used to build the case for one's department and to build a stronger department:

- in seeking equipment and reduced teaching for new faculty;
- as aids in proposal writing;
- in departmental planning and goal setting (for example, in hiring, when unfamiliar with an area);
- as sources for ideas on curricular reform;
- in striving to project a positive image, exhibiting how mathematicians or statisticians make good partners and valuable contributors in many areas of endeavor, and how the mathematical sciences are integral parts of mainstream science;
- in mentoring and encouraging new faculty (for example, for information on how to conduct and improve a graduate program, see [13]);

- to better understand the job market and correctly position the department with the outside world;
- as ideas for contact with industry;
- as sources of justification for increased resources.

Glimm noted that (a) statistics and computing are each needed in the "outside world", and can thus get outside resources; (b) faculty who do outreach will usually have students with few difficulties getting jobs; and (c) increased resources can be obtained provided increased responsibilities are assumed. He recognized that not everyone in the department will want to assume increased responsibilities, but there may be two or three key people who would be interested in carrying out a new thrust. All that is needed, he said, is one person as the "spark plug" who will take ownership of that activity and who is empowered with sufficient resources to do the activity. Once such outreach activities are operating, it could be argued to the dean that the department's nature is no longer that of an ordinary mathematics or statistics department, but is instead more akin to an engineering department (and so should be treated analogously to engineering's treatment in the university formula for resources).

In his closing remarks, Glimm emphasized that the department needs to be politically credible and active in partnerships and teams. He concluded, "I would rather have a share of a winning proposal than total ownership of a losing proposal."

To preface his presentation, Eddy noted that the CMU statistics department has never produced a graduate who has not secured employment. This he attributed to the department's view that statistics is about other people's problems and that collaboration and partnership are the essential approaches by which statistics survives.

Eddy cited recent CATS reports that statisticians can use, such as [17, 12, 14, 7, 11, 6, 4, and 5]. He pointed out that the diversity of topics in these reports reflects the breadth of opportunities and that the reports are of essentially two types: state-of-the-art surveys [17, 12, 14, 4, and 5] and symposium proceedings that were produced so those events would have wide impact ([7, 6, 11]).

The state-of-the-art surveys inform the statistics community of, in Eddy's words, "all these great problems that need to be solved." CATS reports are often reprinted in statistics journals, with the intention of stimulating the interests of individuals who apply statistical methods and of researchers who develop new methods. As clues to how CATS reports can be used, Eddy observed that for each report, some federal agency paid to have it produced, and thus the agency had a reason for doing so (such as focusing research attention to solve an internal problem of importance to the agency, or to encourage a particular area of research in which the agency has interest). He agreed that one should not read all the reports, but rather should pick a useful one and use it to guide the development of a collaboration with another discipline (for example, oceanography).

However, he cautioned that developing a successful collaboration will require the overcoming of many difficulties, including language, culture, and the time it takes to build a collaboration. As examples, he mentioned that while cochairing the CATS study on statistics and oceanography, he discovered that the words "data" and "model" can mean very different things to statisticians and oceanographers; this is detailed in the report "Statistics and Physical Oceanography" [17]. Also, viewpoints for the two cultures can be quite dissimilar (for example, data being seen as "we gathered it, so we own it and will not give it up until we have distilled all the information we can from it" versus "somebody gathered it so everybody owns it and can freely access it"). He stressed that it probably takes about three years to build a collaboration, with successful ones continuing for up to ten years and unsuccessful ones ending in only six months.

As solutions, he offered
- Be patient.
- Use group participation (have several people from each discipline in the room to help break down cultural barriers and develop communication).
- Be patient.
- Train faculty in outreach (cultivate an orientation in department members toward other people's problems).
- Be patient.
- Do not expect everything to result in a theorem. (Progress on the problem is itself an important result, and there must be respect for the other disciplines in the sense that "if it's good for that other discipline, it's good statistics.")
- Be patient.

He strongly emphasized that efforts be aimed to help collaborators solve their problems, under the rationale that the money comes from clients, and if you have solved problems for them, they will say, "We need a good statistics department, so give it money."

In closing discussion, Lavery suggested that ideas could be selected from the reports and brought to the attention of people in the department whose interests they might fit. He suggested that mathematical sciences departments could become strong, equal, and communicative partners with other areas of science and engineering. He mentioned that having a related report in hand when taking a proposal to a dean can increase the chances of a positive outcome. One member of the audience described how he had put forward a proposal in statistics and evolutionary biology and succeeded in obtaining one half of a position when he would otherwise have been relinquishing a position that was being withdrawn after a retirement.

Eddy called for awareness of a natural tension: what is an irritant to the scientist may be what is most interesting to a statistician. He also warned of the danger of consultation, in contrast to in-depth collaboration, where one may only become involved with "baby" problems and at a level that never provides much benefit to the statistician. In this vein, he recommended the report "Cross-Disciplinary Research in the Statistical Sciences" [2]. He felt departments need to follow-up on the high visibility of a topic in the community, citing the report "Combining Information" [12] as an example. Lastly, he noted that ideas are needed on how to change the culture from one primarily concerned with proving theorems, and that

such change may require concerted and continued effort on many different fronts.

The session ended with a reminder that several new BMS and CATS publications are expected in 1994 [19, 20, 21, 22]. Individuals interested in obtaining any of these should contact the Board on Mathematical Sciences, Room NAS 315, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2421, fax 202-334-1597; e-mail `bms@nas.edu`.

References

[1] A. Friedman, J. Glimm, and J. Lavery, *The mathematical and computational sciences in emerging manufacturing technologies and management practices*, SIAM Reports on Issues in the Mathematical Sciences, Society for Industrial and Applied Mathematics, Philadelphia, PA, 1992.

[2] Institute of Mathematical Statistics (IMS), *Cross-disciplinary research in the statistical sciences*, report of a panel of the IMS (I. Olkin and J. Sacks, cochairs), 1988; reprinted in Statistical Science **5** (February 1990), 121-146.

[3] National Research Council (NRC), *Computational modeling and mathematics applied to the physical sciences*, Committee on Applications of Mathematics, National Academy Press, Washington, D.C., 1984.

[4] National Research Council (NRC), *Discriminant analysis and clustering*, Panel on Discriminant Analysis, Classification, and Clustering; Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences; National Academy Press, Washington, D.C., 1988; reprinted in Statistical Science **4** (1) (1989), 34-69.

[5] National Research Council (NRC), *Statistical models and analysis in auditing*, Panel on Nonstandard Mixtures of Distributions, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1988; reprinted in Statistical Science **4** (1) (1989), 2-33.

[6] National Research Council (NRC), *Symposium on statistics in science, industry, and public policy*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1989.

[7] National Research Council (NRC), *The future of statistical software*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1991.

[8] National Research Council (NRC), *Mathematical foundations of high-performance computing and communications*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1991.

[9] National Research Council (NRC), *Mathematical sciences, technology, and economic competitiveness*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1991.

[10] National Research Council (NRC), *Spatial statistics and digital image analysis*, Panel on Spatial Statistics and Image Processing, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1991.

[11] National Research Council (NRC), *Statistics: A guide to assessing societal risk*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1991; portions appeared in Chance **3** (4) (1990), 27-47.

[12] National Research Council (NRC), *Combining information: Statistical issues and opportunities for research*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1992; reprinted by the American Statistical Association in 1993 as Volume **1** in ASA's new Contemporary Statistics series.

[13] National Research Council (NRC), *Educating mathematical scientists: Doctoral study and the postdoctoral experience in the United States*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1992.

[14] National Research Council (NRC), *Probability and algorithms*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1992; reprinted in Statistical Science **8** (1) (1993), 1-80.

[15] National Research Council (NRC), *Clinical trials and statistics*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1993.

[16] National Research Council (NRC), *Mathematical research in materials science: Opportunities and perspectives*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1993.

[17] National Research Council (NRC), *Statistics and physical oceanography*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1993; to be reprinted with invited commentary as the May 1994 issue of Statistical Science.

[18] National Research Council (NRC), *Transportation and the mathematical sciences: The changing interaction*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1993.

[19] National Research Council (NRC), *Calculating the secrets of life: Contributions of the mathematical sciences to molecular biology*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1994 (to appear).

[20] National Research Council (NRC), *Group theory: The language of symmetry in science and technology*, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1994 (to appear).

[21] National Research Council (NRC), *Modern interdisciplinary university statistics education*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1994.

[22] National Research Council (NRC), *Statistical methods in software engineering*, Committee on Applied and Theoretical Statistics, Board on Mathematical Sciences, National Academy Press, Washington, D.C., 1994 (to appear).

University of Oregon, Eugene, Oregon
June 16–18, 1994

Preliminary Program

The eight hundred and ninety-third meeting of the American Mathematical Society (AMS) will be held at the University of Oregon, Eugene, Oregon, on Thursday, Friday, and Saturday, June 16–18, 1994. This meeting will be held in conjunction with a meeting of the Pacific Northwest section of the Mathematical Association of America (MAA).

Invited Addresses

Stephen A. Mitchell, University of Washington, *K-theory for rings of algebraic integers.*

Gustavo A. Ponce, University of California, Santa Barbara, *Nonlinear dispersive equations.*

Karen Parshall, University of Virginia, *Algebras with a Scottish lilt: the life and work of Joseph H. M. Wedderburn (1882-1942).*

Special Sessions

Rings and their representations, **Frank W. Anderson**, University of Oregon, and **Kent R. Fuller**, University of Iowa.

3-manifolds, **Steven A. Bleiler**, Portland State University.

Commutative algebra and probability groups, **Frank R. DeMeyer**, Colorado State University, and **Thomas M. McKenzie**, Bradley University.

Simple C-algebras*, **Chris Phillips**, University of Oregon.

Undergraduate research, **Robby Robson**, Oregon State University.

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

There will also be sessions for contributed ten-minute papers. The deadline for submission of abstracts for these sessions has expired.

Events of Other Organizations

The MAA program will feature **Carl Pomerance**, University of Georgia, who will give the MAA Pólya Lecture on *Witnesses of composite numbers.* **Doris Schattschneider**, Moravian College and first vice-president of the MAA for 1994 and 1995, will be the other featured MAA Hour Speaker. The title of her talk is *Was Escher a mathematician?*. On Saturday morning, **Millie Johnson**, Western Washington University, will will give a talk on *Mathematics of meanders: rivers, channelization, floods, and the environment.*

There will be two minicourses held on Thursday; the registration fees for each will be $20. **James Tattersall**, Providence College, will present a minicourse on the history of the first nine Lucasian professors at Cambridge, starting with Barrow and Newton, and proceeding through Woodhouse. Much of this material, which will include some of their mathematical accomplishments, will be useful in a modern classroom. **Carl E. Swenson**, Seattle University, is presenting a minicourse titled *Using Mathematica to produce graphical classroom materials*. The first presentation will be a presentation of techniques, samples, and ideas for classroom materials, including 3-D graphics, animation, and flipbooks. During the second session participants will create something for their own classroom. *Mathematica* experience will be helpful but not essential.

A panel discussion on *Sensitivity and understanding of the job market* will be moderated by **Kenneth A. Ross**, University of Oregon. The panel will consist of three people who have recently been on the job market (**Charles Mannix**; University of Washington, **Thomas McKenzie**, Bradley University; and **Jennifer McNulty**, University of Montana) and three people who have been department chairs involved with hiring (**Howard Gage**, Whitworth College; **Douglas Lind**, University of Washington; and **Julie H. Lutz**, Washington State University).

The two-year college program will include a panel discussion on *The baby and the bathwater problem*, which will focus on what we throw out of algebra to make room for technological advances. The moderator will be **Stuart Thomas**, University of Oregon. There will also be sessions of contributed papers. Presentations by students are especially solicited. For more information, contact Dick Koch, University of Oregon, Eugene, OR 97403-1222; e-mail: `koch@math.uoregon.edu`.

Accommodations

Rooms have been blocked in the following motels. Participants should make their own arrangements with the motel of their choice and ask for the "math conference rate". All rates are subject to applicable taxes. **Reservations should have been made by May 20, 1994**. There will be a Grateful Dead concert in Eugene that weekend, so very early reservations are advised. The first four motels listed are within a mile of the meeting site; the nearest, Best Western New Oregon Motel, is across the street. The Village Green is 15 miles south of Eugene. **Neither the AMS nor the MAA is responsible for rate changes or the quality of the accommodations.**

Angus Inn Motel: 2121 Franklin Blvd., Eugene, OR 97440. Telephone: 503-342-1243. Single $45 and two beds $55.

Best Western New Oregon Motel: P.O. Box 18, 1655 Franklin Blvd., Eugene, OR 97440. Telephone: 503-683-3669. Single or double $60.50 (restaurants, indoor pool).

Campus Inn: 390 East Broadway, Eugene, OR 97401. Telephone: 503-343-3376. Single $34 and double $40-$42.

Eugene Motor Lodge: 476 East Broadway, Eugene, OR 97401. Telephone: 503-344-5233. Single $28 and double $36.

Village Green: 725 Row River Road, Cottage Grove, OR 97424. Telephone: 503-942-2491 or 800-343-ROOM. Single or double $49 (restaurants, outdoor heated pool, tennis courts).

Dormitory housing on the University of Oregon campus will be available. Details will appear in the spring newsletter of the Pacific Northwest Section (MAA) and are available directly from Ken Ross at the University of Oregon (`ross@bright.uoregon.edu`). Limited housing with local Eugene students will be available to students attending the meeting; those interested should contact Lorna at `hanes@euclid.uoregon.edu`.

Registration

Preregistration is recommended. Members of the MAA in the Pacific Northwest Section will receive a preregistration form and dormitory information in the spring newsletter. All other participants can receive this information by contacting Kenneth A. Ross, Department of Mathematics, University of Oregon, Eugene, OR 97403-1222; or e-mail: `ross@math.uoregon.edu`. **The deadline for preregistration is June 10, 1994. The deadline for dormitory reservations was May 20, 1994**.

The meeting registration desk will be located in the Fir Room of the Erb Memorial Union Building and will be open from 1:00 p.m. to 5:00 p.m. on Thursday, June 16, and 8:00 a.m. to 4:00 p.m. on Friday, June 17, and 9:00 a.m. to noon on Saturday, June 18. The registration fees are $30 for members of the AMS; $20 for participants who are members of MAA only; $45 for nonmembers; and $10 for emeritus members, students, or unemployed mathematicians.

Social Event

The MAA is sponsoring a salmon bake on Friday evening, June 17. All participants are invited to join in. The cost is $16 per person for adults, $12 for children ages eight to twelve years, and no charge for children seven years of age and under. The menu includes baked whole Oregon salmon with cucumber dill sauce and lemon wedges, escalloped potatoes, savory green beans, salad selection, hot buttered French bread, relish tray, fresh fruit platter, apple cake, and assorted beverages. To order tickets, refer to the preregistration procedure described previously.

Travel

American Airlines has been selected as the official airline for this meeting. The following benefits are available exclusively to mathematicians and their families attending the meeting: a savings of up to 10% off any published domestic fare (includes U.S., Canada, Bermuda, the Bahamas, Puerto Rico, and the U.S. Virgin Islands) subject to applicable fare restrictions (10 tickets must be sold). Call 800-433-1790 between 8:00 a.m. and 11:00 p.m. EST to contact American directly or call any licensed travel agent. Instruct the ticket agent to refer to file **#SO144CE** to qualify for the applicable discount.

Shuttle service is available by Express Cab and Shuttle Service from the airport to the University of Oregon campus. At present the cost is $12 for the first customer, $2 for each of the next three customers, and $1 for additional customers. For advance reservations please call 503-341-8444 or 503-741-0564.

To reach the university area from the south on I-5, take exit 192. The highway flows into Franklin Boulevard and the university appears on the left. To reach the university area from the north on I-5, take exit 194B and head west on I-105. Take exit 1 and carefully follow signs to the university. Eventually you will be on Franklin Boulevard and the university will appear on the right. There will be no charge for parking on campus; however, parking permits are required. Parking permits will be sent to preregistrants if requested.

Weather

Eugene weather in June is usually mild and pleasant. Average high temperature is 74°F and the average low temperature is 48°F. Rain in the middle of the month is not unusual. Very hot weather is also possible, but unlikely.

Presenters of Papers

Numbers following the names indicate the speakers' positions on the program.
• Invited Lecturer
* Special Session Speaker
▶ Graduate Student
◀ Undergraduate Student

*▶ Abrams, A. D., 55
* Adams, C., 4
Barnes, D. C., 60
* Barr, M., 64
* Bernhard, J. A., 54
* Beyl, F. R., 41
* Brown, R., 45
* Burgess, W. D., 32
* Chen, A. M., 28
* Claus-McGahan, E., 18
* Cooper, D., 8
*▶ D'Ambrosia, B., 33
* Deck, K., 42
* DeMeyer, F., 20
* Dykema, K. J., 48
* Elliott, G. A., 9
* Farsi, C. E., 50
* Ford, T. J., 21
* Freden, E. M., 40
* Freyd, P., 63
* Gilpin, M. J., 44
* Gong, G., 13
* Goodearl, K. R., 49
* Greither, C., 46
* Haefner, J., 34
* Hempel, J., 1
* Hoste, J., 38
* Huisgen, B. Z., 35
*▶ Ingerman, D., 67
* Jain, S. K., 36
* Jeong, J. A., 47
* Jones, A. C., 2
* Kangas, S. J., 37
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* Kleiner, M., 71
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* Leen, M., 27
* Leise, T. L., 29
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* Li, M.-S., 72
* Lin, H., 11
* Lin, Q., 14
*◀ Lombardi, V. C., 69
* Magid, A. R., 22
* McClanahan, K., 51
* McKenzie, T., 66
• Mitchell, S. A., 70
Musès, C., 59
* Neil, J. R., 3
* Nicholson, W. K., 73
* Pareigis, B., 65
• Parshall, K. V., 30
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• Ponce, G. A., 31
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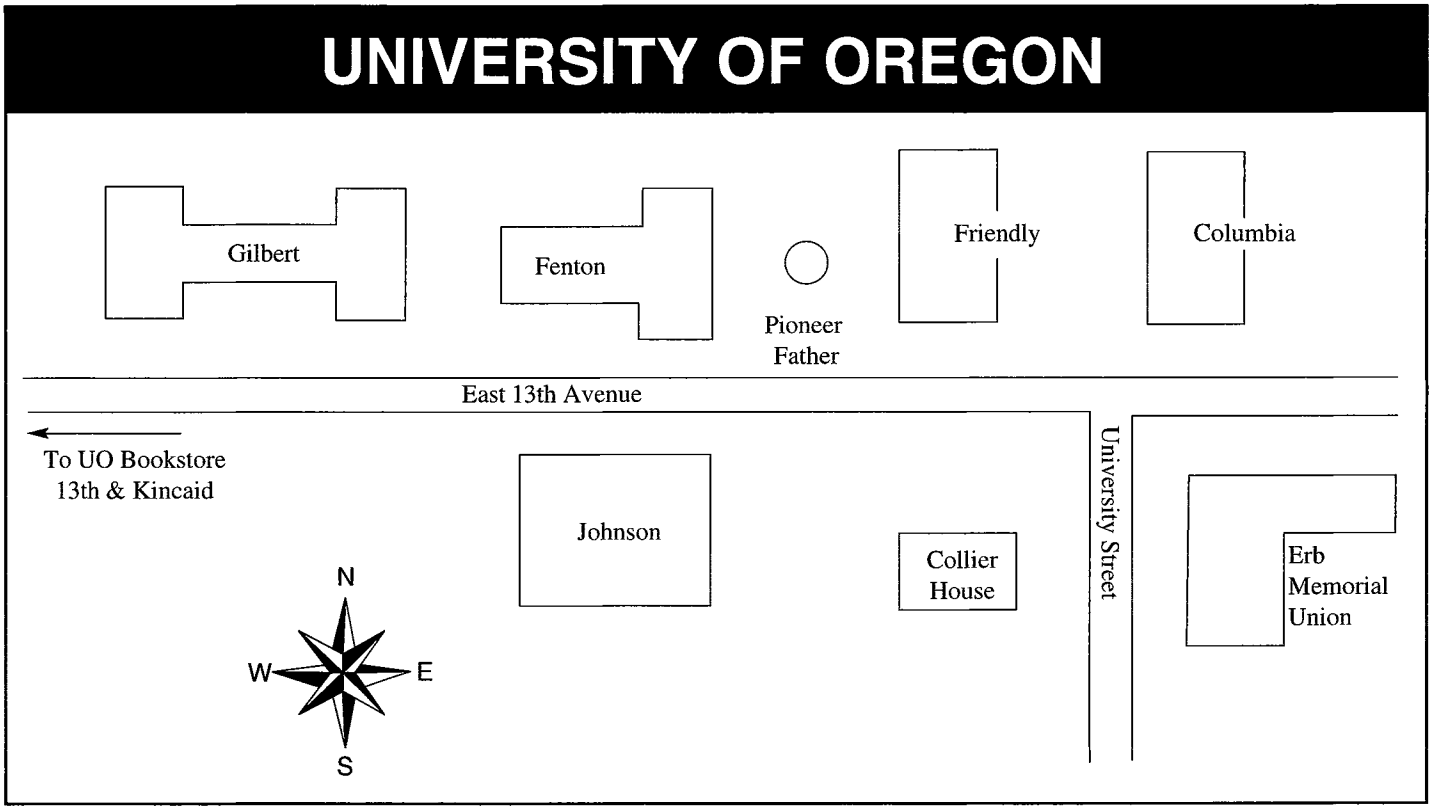
* Zhang, S., 24



Program of the Sessions

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

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

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

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

Thursday, June 16

Special Session on 3-Manifolds, I

2:00 p.m.–5:50 p.m.

2:00 p.m. (1) *Detecting Heegaard splittings of Seifert manifolds.* Preliminary report.
John Hempel, Rice University (893-57-62)

2:30 p.m. (2) *On two-generator 3-manifolds.*
Steven A. Bleiler, Portland State University, and **Amelia C. Jones***, University of California, Davis (893-57-18)

3:00 p.m. (3) *On the genus two 3-manifolds admitting a nontrivial torus decomposition.* Preliminary report.
John R. Neil, Portland State University (893-57-58)

3:30 p.m. (4) *Hyperbolic 3-manifolds and 3-orbifolds with two generators.*
Colin Adams, Williams College (893-57-07)

4:00 p.m. (5) *Incompressible surfaces in hyperbolic bundles.*
A. W. Reid*, University of Cambridge, England, **D. Cooper** and **D. D. Long**, University of California, Santa Barbara (893-57-13)

4:30 p.m. (6) *Embedding curves in the boundary of a handlebody.*
Edith Starr, Vassar College (893-57-28)

5:00 p.m. (7) *Heegaard splittings of Seifert manifolds.*
Yoav Moriah, Technion-Israel Institute of Technology, Israel, and **Jennifer Schultens***, Emory University (893-57-16)

5:30 p.m. (8) *Finite laminations and geometric finiteness.* Preliminary report.
D. Cooper*, **D. D. Long**, University of California, Santa Barbara, and **A. W. Reid**, University of Cambridge, England (893-57-09)

Special Session on Simple C*-Algebras, I

2:00 p.m.–5:50 p.m.

2:00 p.m. ▶ (9) *Classification of certain infinite simple C^*-algebras, II.*
George A. Elliott*, University of Copenhagen, Denmark and University of Toronto, and **Mikael Rørdam**, Odense University, Denmark (893-19-76)

2:30 p.m. (10) *On the classification of certain simple inductive limit C^*-algebras.*
Liangqing Li, University of Toronto (893-46-37)

3:00 p.m. (11) *Classification of direct limits of even Cuntz-circle algebras.*
Huaxin Lin*, State University of New York, Buffalo, and **N. Christopher Phillips**, University of Oregon (893-46-35)

3:30 p.m. (12) *Abelian C^*-subalgebras of C^*-algebras of real rank zero and inductive limit C^*-algebras.*
George A. Elliott, University of Toronto and Copenhagen University, Denmark, **Guihua Gong**, University of Puerto Rico, Rio Piedras, **Huaxin Lin**, State University of New York, Buffalo, and **Cornel Pasnicu***, University of Puerto Rico, Rio Piedras (893-46-30)

4:00 p.m. (13) *Non-isomorphic real rank zero inductive limit C^*-algebras with same K-theory.*
Guihua Gong, University of Toronto (893-46-38)

4:30 p.m. (14) *Cut down method in the inductive limit decomposition of noncommutative tori.* Preliminary report.
George Elliott, University of Copenhagen, Denmark, and **Qing Lin***, Academia Sinica, People's Republic of China (893-46-63) (Sponsored by N. C. Phillips)

5:00 p.m. (15) *The range of the Elliott invariant.*
Jesper Villadsen, Aarhus University, Denmark (893-47-65) (Sponsored by Christopher K. Phillips)

5:30 p.m. (16) *Inductive limit automorphisms of the irrational rotation algebra.*
Samuel G. Walters, University of Western Ontario (893-46-71)

Friday, June 17

Special Session on 3-Manifolds, II

9:00 a.m.–10:20 a.m.

9:00 a.m. (17) *Comparing Heegaard splittings of non-Haken 3-manifolds.* Preliminary report.
Hyam Rubinstein, Melbourne University, Australia, and **Martin Scharlemann***, University of California, Santa Barbara (893-57-22)

9:30 a.m. (18) *How to obtain a large collection of Laminar 3-manifolds.* Preliminary report.
Elly Claus-McGahan, University of Puget Sound (893-57-10)

10:00 a.m. (19) *Surgery information from surfaces.*
Rachel Roberts, California Institute of Technology (893-57-15)

Special Session on Commutative Algebra and Probability Groups, I

9:00 a.m.–10:50 a.m.

9:00 a.m. (20) *Equivalence of matrices over commutative rings.* **Frank DeMeyer**, Colorado State University (893-13-68)

9:30 a.m. (21) *Topological invariants of a fan associate to a toric variety.* Preliminary report. **Timothy J. Ford**, Florida Atlantic University (893-14-42)

10:00 a.m. (22) *Tensor products, equivalence relations, and Galois theory.* **Andy R. Magid**, University of Oklahoma (893-13-06)

10:30 a.m. (23) *Biquadratic Hopf-Galois extensions.* **H. F. Kreimer, Jr.**, Florida State University (893-16-40)

Special Session on Simple C*-Algebras, II

9:00 a.m.–10:50 a.m.

9:00 a.m. (24) *Purely infinite simple C^*-algebras generated by one projection and reduced group C*-algebras.* **Shuang Zhang**, University of Cincinnati (893-46-60)

9:30 a.m. (25) *C^*-algebras of dynamical systems of quasi rotations on tori.* **Neil A. Watling***, Widener University, and **Carla E. Farsi**, University of Colorado, Boulder (893-46-24)

10:00 a.m. (26) *K-theoretic classification for certain inductive limit order two actions C^*-algebras.* **Hongbing Su**, University of California, Berkeley (893-46-34)

10:30 a.m. (27) *Factorization in purely infinite simple C^*-algebras.* **Michael Leen**, University of Oregon (893-47-59)

Special Session on Undergraduate Research, I

9:00 a.m.–10:10 a.m.

9:00 a.m. (28) *Monte Carlo simulation of chromosome aberrations.* Preliminary report. **Allen M. Chen*** and **Rainer K. Sachs**, University of California, Berkeley (893-92-66)

9:40 a.m. (29) *On the canonical proboscis.* **Robert Finn**, Stanford University, and **Tanya L. Leise***, Texas A & M University, College Station (893-49-55)

Invited Address

11:00 a.m.–11:50 a.m.

(30) *Algebras with a Scottish lilt: The life and work of Joseph H. M. Wedderburn (1882-1948).* **Karen V. H. Parshall**, University of Virginia (893-01-01)

Invited Address

2:30 p.m.–3:20 p.m.

(31) *Nonlinear dispersive equations.* Preliminary report. **Gustavo A. Ponce**, University of California, Santa Barbara (893-35-04)

Special Session on Rings and Their Representations, I

3:30 p.m.–5:50 p.m.

3:30 p.m. (32) *Ideal extensions and Pierce sheaves.* Preliminary report. **W. D. Burgess***, University of Ottawa, and **R. Raphael**, Concordia University (893-16-17)

4:00 p.m. (33) *Square-free rings.* Preliminary report. **Barbara D'Ambrosia**, University of Oregon (893-16-54)

4:30 p.m. (34) *On when a graded ring is graded equivalent to a crossed product.* Preliminary report. **Jeremy Haefner**, University of Colorado, Boulder (893-16-31)

5:00 p.m. (35) *The geometry of uniserial representations of finite dimensional algebras.* **Birge Zimmermann Huisgen**, University of California, Santa Barbara (893-16-61)

5:30 p.m. (36) *Simultaneous relative injective hulls.* Preliminary report. **S. K. Jain***, **Sergio R. Lopez-Permouth** and **Safdar Raza Syed**, Ohio University, Athens (893-16-44)

Special Session on 3-Manifolds, III

3:30 p.m.–5:50 p.m.

3:30 p.m. (37) *Linear representations of mapping class groups.* **Steven J. Kangas**, Ciudad Universitaria, Mexico (893-57-23) (Sponsored by Amelia C. Jones)

4:00 p.m. (38) *Describing open 3-manifolds by means of infinite framed links.* Preliminary report. **Jim Hoste**, Pitzer College (893-57-12)

4:30 p.m. (39) *Topological quantum field theory and 3-manifolds.* **Charles Frohman**, University of Iowa, and **Joanna Kania-Bartoszynska***, Boise State University (893-57-11)

5:00 p.m. (40) *Negatively curved groups have the convergence property,* II. Preliminary report. **Eric M. Freden**, Brigham Young University (893-20-19)

5:30 p.m. (41) *On the classification of 2-complexes with spherical-space-form fundamental groups.* Preliminary report. **F. Rudolf Beyl***, **M. Paul Latiolais** and **Nancy Waller**, Portland State University (893-57-21)

Friday, June 17 (cont'd)

Special Session on Commutative Algebra and Probability Groups, II

3:30 p.m.–5:50 p.m.

3:30 p.m. (42) *A comparison of the tight radical and the radical of the group of automorphisms of a transcendental field extension.*
Karin Deck, University of North Carolina, Wilmington (893-12-14)

4:00 p.m. (43) *On valuations and term orderings of polynomial rings.*
Marie A. Vitulli, University of Oregon (893-13-20)

4:30 p.m. (44) *Vandermonde's identity and Klee's identity as bilinear forms.*
Michael J. Gilpin, Michigan Technological University (893-05-53)

5:00 p.m. (45) *Rational places on algebraic function fields.*
Ron Brown*, University of Hawaii, Honolulu, and **Jonathan L. Merzel**, Holy Names College (893-12-47)

5:30 p.m. (46) *Galois extensions of rings and Galois cohomology.*
C. Greither, Math Institute, Germany (893-13-33)

Special Session on Simple C*-Algebras, III

3:30 p.m.–5:50 p.m.

3:30 p.m. (47) *Purely infinite simple C^* crossed products.*
Ja A. Jeong, Seoul National University, Korea (893-46-69)

4:00 p.m. (48) *On the Fock representation of the q-commutation relations.*
Kenneth J. Dykema* and **Alexandru Nica**, University of California, Berkeley (893-46-29)

4:30 p.m. (49) *Multiplier algebras of simple C^*-algebras with real rank zero.*
K. R. Goodearl, University of California, Santa Barbara (893-46-43)

5:00 p.m. (50) *Rational symmetrized tori.* Preliminary report.
Carla E. Farsi*, University of Colorado, Boulder, and **Neil Watling**, Widener University (893-46-41)

5:30 p.m. (51) *Simplicity of reduced amalgamated products of C^*-algebras.*
Kevin McClanahan, University of Mississippi (893-47-48)

Special Session on Undergraduate Research, II

3:30 p.m.–6:00 p.m.

3:30 p.m. (52) *On cyclotomic polynomials, power residues, and reciprocity laws.*
Romyar Sharifi, Berkeley, California (893-11-67) (Sponsored bv Robert O. Robson)

4:10 p.m. (53) *Counting pandiagonal magic squares.*
Joshua L. Levenberg, Reed College (893-05-72) (Sponsored by Robert O. Robson)

4:50 p.m. (54) *Unknoting numbers and minimal knot diagrams.*
James A. Bernhard, Harvard University (893-57-73)

5:30 p.m. ▸ (55) *Upper chromatic numbers.*
Aaron D. Abrams, University of California, Berkeley (893-05-52)

Saturday, June 18

Session on Contributed Papers

8:00 a.m.–9:20 a.m.

8:00 a.m. (56) *Irreducible representations of Lie algebras of reductive groups and the Kac-Weisfeiler conjecture.* Preliminary report.
Alexander Premet, University of Hamburg, Germany (893-17-02)

8:15 a.m. (57) *A characterization of ultrafilters in a complementary topology.*
Rahim G. Karimpour, Southern Illinois University, Edwardsville (893-54-25) (Sponsored by Chung-Wu Ho)

8:30 a.m. (58) *Backward shifts on $C(X)$.* Preliminary report.
M. Rajagopalan, Tennessee State University, and **K. Sundaresan***, Cleveland State University (893-46-26)

8:45 a.m. (59) *The Fibonacci series: Functional basis and generalization of nth term.*
C. Musès, Mathematics & Morphology Research Center, Canada (893-11-46)

9:00 a.m. (60) *Positivity conditions for quadratic forms and applications.*
Jimin Tian, Richland College, and **David C. Barnes***, Washington State University (893-35-57)

9:10 a.m. (61) *Counting spanning converging forests.*
Elena Shamis, Institute of Control Sciences, Russia (893-06-75) (Sponsored by Eynshteyn Averbukh)

Special Session on Commutative Algebra and Probability Groups, III

8:30 a.m.–10:50 a.m.

8:30 a.m. (62) *Klein-Hilbert parts of convex modules.*
D. Pumpluen, Fern University, Germany, and **H. Rohrl***, La Jolla, California (893-52-56)

9:00 a.m. (63) *Dave Harrison and the beginnings of category theory.*
Peter Freyd, University of Pennsylvania (893-18-27)

9:30 a.m. (64) *Acyclic models.*
Michael Barr, McGill University (893-13-08)

10:00 a.m. (65) *Reconstruction of hidden symmetries.*
Bodo Pareigis, University of Munich, Germany (893-16-74)

10:30 a.m. (66) *Weakly Henselian rings.*
Thomas McKenzie, Bradley University (893-13-64)

Special Session on Undergraduate Research, III

8:30 a.m.–10:20 a.m.

8:30 a.m. ▸ (67) *Circular planar graphs and resistor networks.* **David Ingerman**, University of Washington (893-05-70)

9:10 a.m. ▸ (68) *Approaches to an inverse problem concerning electrical networks.* Preliminary report. **Kevin Rosema**, University of Washington (893-94-50) (Sponsored by Robert O. Robson)

9:50 a.m. ▸ (69) *CD-4/CD-8 ratios in chronic fatigue and AIDS patients.* **Vincent C. Lombardi*** and **Suzanne C. Welsch**, Sierra Nevada College (893-62-51) (Sponsored by Robert O. Robson)

Invited Address

11:00 a.m.–11:50 a.m.

(70) *K-theory for rings of algebraic integers.* **Stephen Ames Mitchell**, University of Washington (893-11-05)

Special Session on Rings and Their Representations, II

2:30 p.m.–4:50 p.m.

2:30 p.m. (71) *Stable Artin algebras: Structure and representations.* Preliminary report. **S. Jagadeeshan** and **Mark Kleiner***, Syracuse University (893-16-36)

3:00 p.m. (72) *Faithful representations of finite-dimensional algebras.* Preliminary report. **Ming-Sun Li**, University of Minnesota, Morris (893-16-49)

3:30 p.m. (73) *On principally injective rings.* **W. K. Nicholson***, University of Calgary, and **M. F. Yousif**, Ohio State University, Lima (893-16-03)

4:00 p.m. (74) *Direct sums of reflexive modules.* **K. R. Fuller**, University of Iowa, **W. K. Nicholson**, University of Calgary, and **J. F. Watters***, University of Leicester, England (893-16-32) (Sponsored by Kent R. Fuller)

4:30 p.m. (75) *A class of left monomial rings.* Preliminary report. **Darren D. Wick**, University of Oregon (893-16-45)

Lance W. Small
Associate Secretary
La Jolla, California

Minneapolis Mathfest
Minneapolis, Minnesota, August 15–17, 1994

Supplement to Announcement in April Notices

Scientific Program

Please see the first announcement of the Mathfest in the April *Notices*.

AMS Sessions

The Committee on Education panel discussion will not be held.

MAA Sessions

The title of **Pamela J. Drummond**'s MAA-Mu Alpha Theta Lecture is *Generating enthusiasm while achieving equality in mathematics*.

The Minicourse advance registration form is now available on e-MATH via e-mail. It may be requested by telnetting to `e-MATH.ams.org` (login and password are "e-math"), selecting [10] GOPHER from the main menu, then selecting [11] Meetings and Conferences and following the instructions. VISA or MasterCard is the ONLY method of payment which will be accepted for electronic advance registration. Charges to credit cards will be made in U.S. funds.

Other MAA Events

Breakfast for MAA Visiting Mathematicians: This event will take place on Wednesday, 7:00 a.m. to 8:20 a.m., for past, present, and potential future visiting mathematicians at the MAA. These are people who arrange to work at the MAA headquarters in Washington while on sabbatical, during retirement, etc. The low-key program will consist of informal dialogue among the attendees. Anyone interested in being included should contact the MAA executive director, Marcia P. Sward.

IMPORTANT DEADLINES

AMS abstracts	
For consideration for Special Sessions	**Expired**
Special Sessions and contributed papers	**Expired**
MAA abstracts of contributed papers	**Expired**
ORDINARY advance registration	**June 11**
Hotel/residence hall accommodations (MMSB)	**June 11**
Tickets through advance registration	**June 11**
MAA Minicourse advance registration (MAA)	**June 11**
MAA Student Papers	**June 25**
Hotel changes and cancellations (MMSB)	**July 5**
FINAL advance registration (no housing or tickets)	**July 14**
Motions for AMS Business Meeting	**July 16**
Cancellations for all banquets and tours (50% refund)	**August 1**
Residence hall changes and cancellations through MMSB (90% refund)	**August 8**
Advance registration cancellations (50% refund)	**August 11**

Activities of Other Organizations

The **Association for Women in Mathematics** panel discussion is titled *Celebrating women's achievements in algebra, analysis, combinatorics, and geometry: past, present, and future*. Panelists include **Jane P. Gilman**, Rutgers University; **Karen Saxe**, Macalester College; **Doris J. Schattschneider**, Moravian College; and **Marie A. Vitulli**, University of Oregon. The organizer and moderator is **Joan Hutchinson**, Macalester College.

The **National Association of Mathematicians** (NAM) is pleased to announce a Special Invited Lecture (to be named) which will take place in Minneapolis and at all future Mathfests. The lecture, scheduled on Tuesday, 1:00 p.m. to 1:50 p.m., will be given by **David Blackwell**, University of California, Berkeley, and is titled *Large deviations for martingales*.

Miscellaneous Information

Travel: The Airport Express shuttle has increased its rates to $10 one way and $15.50 round trip.

Tours

A Walk on the Wild Side: Part of this tour was to include a visit to the Minnesota Valley National Wildlife Refuge. Instead, your deluxe motorcoach will take you to Wood Lake Nature Center. Here you will enjoy your box lunch (included in the cost of the tour) in the picnic area complete with tables, green spaces, and restrooms. Lunch will be followed by a tour led by a naturalist and will feature an overview of this outdoor educational site. View the bird nesting sites, the interpretive center, nature trails—all this and more!

Invited Addresses, Special Sessions, and Contributed Papers

Invited Addresses at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places indicated. For some meetings the list of speakers is incomplete. For full announcements or programs of meetings occurring prior to the first meeting listed below, see the table of contents in this issue. twelve to eighteen months in advance of a meeting. Members wishing to nominate candidates for invited addresses should send relevant information to the associate secretary for the section, who will forward it to the Section Program Committee.

Stillwater, OK, October 1994

V. Lakshmibai
David E. Marker
David J. Wright
Joel Zinn

Richmond, VA, November 1994

Loren D. Pitt
Cora S. Sadosky
Doron Zeilberger

San Francisco, CA, January 1995

Jerry L. Bona
Jeff N. Kahn
John William Lott
Andrew J. Majda (Gibbs Lecture)
Leila Schneps
Doris J. Schattschneider (AMS-MAA)
John Smillie

Hartford, CT, March 1995

Ben F. Logan
Nina N. Uraltseva
Kari Vilonen
Shouwu Zhang

Chicago, IL, March 1995

Rodrigo Banuelos
Berit Stensones
Jeremy T. Teitelbaum
Efim Zelmanov

Kent, OH, November 1995

Luchezar L. Avramov
Alice Silverberg
Peter J. Sternberg
Rodolfo H. Torres

Orlando, FL, March 1996

Dave Benson
Bjorn Jawerth
Krystyna M. Kuperberg
De Witt L. Sumners

Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of the *Notices* went to the printer.

October 1994 Meeting in Stillwater, Oklahoma
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: July 13, 1994

Efraim Armendariz, D. J. Lewis, Andy R. Magid, and Robert J. Zimmer, *New doctoral work in mathematics*
Ara S. Basmajian and Robert R. Miner, *Complex hyperbolic geometry and discrete groups*
Edward T. Cline, *Representations of algebraic groups*
Brian Conrey and William D. Duke, *Number theory*
Bruce C. Crauder and Zhenbo Qin, *Algebraic geometry*
Edward G. Dunne and Roger C. Zierau, *Geometry and representations of Lie groups*
Alan R. Elcrat, *Fluid dynamics*
Benny D. Evans, *The evolving undergraduate mathematics curriculum*
Vladimir Ezhov and Alan V. Noell, *Several complex variables*
Jerry A. Johnson, *Technology in the classroom*
Mark W. McConnell, *Arithmetic groups and topology*
Phillip E. Parker, *Geometry and geodesics*

November 1994 Meeting in Richmond, Virginia
Southeastern Section
Associate Secretary: Robert J. Daverman
Deadline for organizers: Expired
Deadline for consideration: July 13, 1994

Joseph A. Ball and Cora S. Sadosky, *Interpolation and dilation theory*
Amer Beslagic, *Set theoretic topology and set theory*
Paul S. Bourdon and William T. Ross, *Operators on Banach spaces of analytic functions*
Douglas L. Costa and Gordon E. Keller, *Groups, rings, and forms*
James A. Davis and Harold N. Ward, *Codes and designs*
Ira W. Herbst, *Quantum mechanics*
Teresa Magnus, *Nonassociative algebras*
John P. Nolan, *Stochastic processes*
Rodica E. Simion and Doron Zeilberger, *Identities and enumeration*

January 1995 Meeting in San Francisco, California
Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: September 9, 1994

Alex Adem and Jon F. Carlson, *Cohomology and representations of finite groups*
Walter Allegretto, Alfonso Castro, and Ratnasingham Shivaji, *Nonlinear elliptic boundary value problems and applications*
Thomas Archibald and Victor J. Katz, *History of mathematics*
Michael Aschbacher and Stephen D. Smith, *The simple group classification: Second generation proof and applications*
Eric D. Bedford and John Smillie, *Complex dynamics*
David C. Carothers, *Undergraduate research*
Gary Chartrand and Michael S. Jacobson, *Graph theory*
Saber N. Elaydi, John R. Graef, and William Trench, *Difference equations: Theory and applications*
Ben A. Fusaro and Suzanne M. Lenhart, *Environmental modeling*
Naomi Fisher, Harvey B. Keynes, Kenneth C. Millett, Hugo Rossi, and Christine Stevens, *Mathematics and education reform*
Jacob E. Goodman and Janos Pach, *Discrete geometry*
Daniel L. Goroff, *Research on undergraduate mathematics education*
Ian Graham and David Minda, *Several complex variables*
Shouchuan Hu and Nikolaos S. Papageorgiuo, *Multivalued dynamical systems and applications*
A. G. Karstatos, *Theory and applications of nonlinear operators of accretive and monotone type*
Ellen E. Kirkman and James J. Kuzmanovich, *Noncommutative algebra*
Yanping Lin, *Numerical solution for integro-differential equations*
Terry A. Loring, *Almost multiplicative maps, C^*-algebras, and deformations*
John William Lott and Rafe R. Mazzeo, *Index theory and elliptic operators on manifolds*
Benjamin A. Lotto, *Holomorphic spaces*
Daniel Madden, *Effective approaches to the training of teaching assistants*
David E. Marker and Charles I. Steinhorn, *Model theory*
John L. Orr and David R. Pitts, *Non self adjoint operator algebras*
Jack R. Quine and Peter Sarnak, *Extremal Riemann surfaces*
Douglas C. Ravenel, *Homotopy theory*
Sivapragasam Sathananthan, *Stochastic systems and applications*
Seenith Sivasundaram, *Nonlinear dynamics*
Curtis D. Tuckey, *Applied logic*
Bernd Ulrich and Wolmer V. Vasconcelos, *Commutative algebra: Rees algebras and related topics*
Roger A. Wiegand and Sylvia M. Wiegand, *Commutative Noetherian rings and modules*

March 1995 Meeting in Hartford, Connecticut
Eastern Section
Associate Secretary: Lesley M. Sibner
Deadline for organizers: June 3, 1994
Deadline for consideration: To be announced

David A. Cox, *Enumerative geometry, toric varieties, and mirror symmetry*

March 1995 Meeting in Orlando, Florida
Southeastern Section
Associate Secretary: Robert J. Daverman
Deadline for organizers: June 17, 1994
Deadline for consideration: To be announced

Marcy Barge, *The geometry of dynamical systems*
Philip L. Bowers, *Discrete conformal geometry*
Robert C. Brigham and Richard P. Vitray, *Combinatorics and graph theory*
John R. Cannon, *Inverse and ill-posed problems*
S. Roy Choudhury, *Nonlinear dynamical systems, chaos, and turbulence*
S. Roy Choudhury and Lokenath Debnath, *Solitons and nonlinear waves*
Sam Huckaba and Bernard L. Johnston, *Commutative algebra*
Xin Li and Ram N. Mohapatra, *Approximation theory and special functions*
Piotr Mikusinski, *New trends in generalized functions*
De Witt L. Sumners, *Scientific applications of geometry and topology*
Ahmed I. Zayed, *Sampling theory, wavelets, and signal processing*

March 1995 Meeting in Chicago, Illinois
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: June 24, 1994
Deadline for consideration: To be announced

William Chin and Ian M. Musson, *Hopf algebras and quantum groups*
Stephen R. Doty, Daniel K. Nakano, and Karl M. Peters, *Lie theory*
Richard J. Maher, *Mathematics education reform*
Mary H. Wright, *Rings and modules*

May 1995 Meeting in Givat Ram, Jerusalem, Israel
(Joint Meeting with the
Israel Mathematical Union)
Associate Secretary: Lance W. Small
Deadline for organizers: August 24, 1994
Deadline for consideration: To be announced

August 1995 Mathfest in Burlington, Vermont
Associate Secretary: Robert J. Daverman
Deadline for organizers: November 4, 1994
Deadline for consideration: To be announced

October 1995 Meeting in Boston, Massachusetts
Eastern Section
Associate Secretary: Lesley M. Sibner
Deadline for organizers: January 6, 1995
Deadline for consideration: To be announced

November 1995 Meeting in Kent, Ohio
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: February 4, 1995
Deadline for consideration: To be announced

November 1995 Meeting in Greensboro, North Carolina
Southeastern Section
Associate Secretary: Robert J. Daverman
Deadline for organizers: February 17, 1995
Deadline for consideration: To be announced

January 1996 Meeting in Orlando, Florida
Associate Secretary: Lance W. Small
Deadline for organizers: April 12, 1995
Deadline for consideration: To be announced

March 1996 Meeting in Iowa City, Iowa
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: June 22, 1995
Deadline for consideration: To be announced

Daniel D. Anderson, *Commutative ring theory*
Tuong Ton-That, *Group representations and mathematical physics*

April 1996 Meeting in New York, New York
Eastern Section
Associate Secretary: Lesley M. Sibner
Deadline for organizers: July 13, 1995
Deadline for consideration: To be announced

April 1996 Meeting in Baton Rouge, Louisiana
Southeastern Section
Associate Secretary: Robert J. Daverman
Deadline for organizers: July 19, 1995
Deadline for consideration: To be announced

November 1996 Meeting in Columbia, Missouri
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: February 1, 1996
Deadline for consideration: To be announced

Mark S. Ashbaugh, *Partial differential equations and mathematical physics*
Nakhle Habib Asmar and Stephen J. Montgomery-Smith, *Harmonic analysis and probability*
Z. Q. Chen and Zhongxin Zhao, *Stochastic analysis*
Carmen C. Chicone and Yuri Latushkin, *Differential equations and dynamical systems*
Steven Dale Cutkosky and Hema Srinivasan, *Commutative algebra*
Fritz Gesztesy, *Spectral theory and completely integrable systems*
Jan Segert and Shuguang Wang, *Gauge theory and its interaction with holomorphic and symplectic geometry*

January 1997 Meeting in San Diego, California
Associate Secretary: Lesley M. Sibner
Deadline for organizers: April 8, 1996
Deadline for consideration: To be announced

January 1998 Meeting in Baltimore, Maryland
Associate Secretary: Robert J. Daverman
Deadline for organizers: April 10, 1997
Deadline for consideration: To be announced

Information for Organizers

Potential organizers should refer to the January issue of the *Notices* for guidelines on organizing a session. Proposals for any of the meetings mentioned in the preceding section should be sent to the cognizant associate secretary by the deadline indicated. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

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Southeastern Section
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Department of Mathematics
University of Tennessee
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Telephone: 615-974-6577

Other Information

General information for speakers and full instructions for submitting abstracts, as well as information on site selection for Sectional Meetings, can be found in the January issue of the *Notices*. Electronic submission of abstracts is available to those who use the TEX typesetting system. The instructions for obtaining the envelopes for electronic abstacts from e-MATH via e-mail have changed slightly from those published in the January issue. Here are the updated instructions:

1. Type `telnet e-math.ams.org`.
2. Login and password are both `e-math`.
3. Type Q to bypass welcome information and go directly to the Main Menu.
4. In the Main Menu, select #10 for Gopher.
5. In Gopher, select #11 for Meetings and Conferences.

6. In Meetings and Conferences, select #2 for Abstract and registration forms, and then #1 for Abstracts and select the type of TEX macro package needed.

Users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to Electronic Abstracts, AMS Meetings Department, P.O. Box 6887, Providence, RI 02940. When requesting the abstracts package, be sure to specify either the plain TEX, $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX, or the LATEX package. Requests for general information concerning abstracts may be sent to `abs-misc@math.ams.org`. Completed electronic abstracts should be submitted to `abs-submit@math.ams.org`.

The Legacy of Norbert Wiener: A Centennial Symposium

Massachusetts Institute of Technology, Cambridge, Massachusetts

October 8–15, 1994

A symposium cosponsored by the American Mathematical Society and the Massachusetts Institute of Technology on *The legacy of Norbert Wiener: A centennial symposium*, in honor of the 100th anniversary of the birth of Norbert Wiener, will take place at MIT, Cambridge, Massachusetts, from Saturday, October 8, to Saturday, October 15, 1994. The symposium will be supported by Henry Singleton, MIT, and the Sloan Foundation; and funding is anticipated from the National Science Foundation. Proceedings will be published by the AMS.

The AMS organizing committee for the symposium includes **David Benney** (MIT), **Roger Brockett** (Harvard University), **Donald Burkholder** (University of Illinois), **David Jerison** (chair, MIT), **P. R. Masani** (University of Pittsburgh), **Henry P. McKean** (Courant Institute), **Daniel Stroock** (MIT), **Isadore M. Singer** (MIT), **Elias M. Stein** (Princeton University). The AMS committee is working in conjunction with an MIT committee consisting of **Jonathan Allen** (MIT), **David Benney** (chair, MIT), **Edward E. David** (EED, Inc.), **Peter Elias** (MIT), **Morris Halle** (MIT), **David Jerison** (MIT), **William Ted Martin** (MIT), **Sanjoy Mitter** (MIT), **Walter Rosenblith** (cochair, MIT), **Jerome Wiesner** (cochair, MIT).

The symposium will begin with mathematical talks on current research directions in harmonic analysis, integration in function space, and potential theory–the areas of Norbert Wiener's fundamental contributions to mathematics. Wiener was remarkable for his ability to find deep connections between mathematics and other fields. Physics, electrical engineering, economics, and biology have strong and growing relationships to mathematics. We have asked speakers representing each of these disciplines to discuss the role of mathematics in their subject. Throughout the week there will be talks devoted to Wiener's intellectual development and his profound influence on his colleagues at MIT and elsewhere. Among the honored guests will be Joseph Doob (University of Illinois) and Kiyosi Ito (Kyoto University).

An important goal of the conference is to alert the mathematical, scientific, and engineering community to new opportunities for interactions between mathematics and other disciplines. Norbert Wiener's life work demonstrates the importance of advanced mathematics in applications.

A partial list of prospective speakers:

Mathematics (October 8-10)

J. Bourgain (IAS), L. Carleson (Royal Institute, Stockholm), C. Fefferman (Princeton University), V. Guillemin (MIT), P.W. Jones (Yale University), P. Malliavin (University of Paris, VI), P.R. Masani (University of Pittsburgh), Henry P. McKean (Courant Institute), Y. Meyer (University of Paris, IX) , I.E. Segal (MIT), I.M. Singer (MIT), J. Sjostrand (University of Paris, XI), E.M. Stein (Princeton University), H. Widom (University of California, Santa Cruz).

Statistical Physics (October 11)

Boris Altshuler (MIT), Michael E. Fisher (University of Maryland), David Nelson (Harvard University), Yakov Sinai (Princeton University), Thomas Spencer (IAS).

Electrical Engineering & Computer Science (October 12)

Amar Bose (MIT and Bose Corporation), Robert Brayton (Berkeley), Robert Gallager (MIT), Tom Kailaith (Stanford University), Sanjoy Mitter (MIT), Michael Rabin (Harvard University and Hebrew University).

Financial Economics (October 13)

Paul Samuelson (MIT), Robert Merton (Harvard University), Stephen Ross (Yale), Andrew Lo (Sloan School of Management), Charles Sanford (chairman of the board, Banker's Trust).

Biology (October 14-15)

Nancy Kopell (Boston University), Michael Levitt (Stanford University), Robert May (Oxford University), David Mumford (Harvard University), Tomaso Poggio (MIT).

There may also be an historical program on Saturday, October 15, at Tufts University, where Norbert Wiener matriculated in 1906.

Accommodations will be in area hotels, either a short walk from the MIT campus or a short subway ride away. Other accomodations will be in bed & breakfasts all over the city. MIT is conveniently reached by subway or taxi from the rail terminus, South Station, or Logan Airport in a matter of minutes. The meeting area will be close to the Institute Science Library, and nearby discussion/seminar rooms will be available.

A brochure of information will be mailed to all who are invited to attend the symposium. The brochure will include information on housing and meals, travel, and local information. Participants will be responsible for making their own housing and travel arrangements. It is expected that funding will be available for a limited number of participants. Limited support is expected to be available for graduate students.

Those interested in attending the symposium should send the following information to the Wiener Symposium Conference Coordinator, Meetings and Conferences Department, American Mathematical Society, P. O. Box 6887,

Providence, RI 02940-6887; fax: 401-455-4004; e-mail: chh@math.ams.org.

Please type or print the following:

1. Full name
2. Mailing address
3. Area code and telephone number for office and home, e-mail address, fax number
4. A short paragraph describing your scientific background relevant to the topic of the conference
5. Dates attending
6. Financial assistance requested; estimated cost of travel
7. Indicate if support is not required and if interested in attending even if support is not offered
8. Indicate if graduate student, undergraduate student, or Ph.D. received on or after 7/1/88

The deadline for receipt of requests for information is June 1, 1994. Requests to attend will be forwarded to the Organizing Committee for consideration after the deadline. All applicants will receive a formal invitation, brochure of information, notification of financial assistance, and a tentative scientific program (if the cochairs have prepared one in advance; otherwise, programs will be distributed on-site). Funds available for the symposium are limited, and individuals who can obtain support from other sources should do so. The allocation of grant funds is administered by the AMS office, and the logistical planning for the conferences is also done by the AMS. However, it is the responsibility of the cochairs of the Organizing Committee to determine the amount of support participants will be awarded. Women and minorities are encouraged to apply and participate in this symposium.

Any questions concerning the scientific portion of the symposium should be directed to **David Jerison**, MIT, Room 2-180, Cambridge, MA 02139; telephone: 617-253-4394; e-mail: jerison@math.mit.edu.

Call For Topics For 1996 Conferences

Suggestions are invited from mathematicians, either singly or in groups, for topics for the various conferences that will be organized by the Society in 1996. The deadlines for receipt of these suggestions are given below, as well as some relevant information about each of the conferences. An application form to be used when submitting suggested topic(s) for any of these conferences (except the Short Course Series) may be obtained by writing to the Director of Meetings, American Mathematical Society, P.O. Box 6887, Providence, RI 02940; or by telephone: 401-455-4146; fax: 401-455-4004; e-mail: `meet@math.ams.org`.

Individuals willing to serve as organizers should be aware that an Associate Executive Director of the Society will prepare the grant application(s) to appropriate federal funding agencies and do follow-up correspondence until grant funds have been secured. Also, the professional conference coordinators in the Society's Providence office will provide full support and assistance before, during, and after each of these conferences, thereby relieving the organizers of most of the administrative detail. Organizers should also note that for all conferences, except Summer Research Conferences, it is required that the proceedings be published by the AMS, and that proceedings of Summer Research Conferences are frequently published. A member of the Organizing Committee must be willing to serve as editor of the proceedings.

All suggestions must include (1) the names and affiliations of proposed members and the chair of the Organizing Committee; (2) a one- to two-page description addressing the focus of the topic, including the importance and timeliness of the topic, and estimated attendance; (3) a list of the recent conferences in the same or closely related areas; (4) a tentative list of names and affiliations of the proposed principal speakers; and (5) a list of likely candidates who would be invited to participate, and their current affiliations. Individuals submitting conference suggestions are requested to recommend sites or geographic areas, which would assist the Meetings staff in their selection of an appropriate site.

1996 AMS Summer Research Institute

Summer Institutes are intended to provide an understandable presentation of the state of the art in an active field of research in pure mathematics and usually extend over a three-week period. Dates for a Summer Institute must not overlap those of the Society's summer meeting, which is scheduled for August. There should be a period of at least two weeks between them. Current and recent topics and chairs of organizing committees:

1991—*Algebraic groups and their generalizations*, **William Haboush**, University of Illinois, Urbana-Champaign.
1992—*Quadratic forms and division algebras: Connections with algebraic K-theory and algebraic geometry*, **William Jacob** and **Alex Rosenberg**, University of California, Santa Barbara.
1993—*Stochastic analysis*, **Michael Cranston**, University of Rochester; **Richard T. Durrett**, Cornell University; and **Mark A. Pinsky**, Northwestern University.
1994: No institute will be held.
1995—*Algebraic geometry*, **Robert Lazarsfeld**, University of California, Los Angeles.

Proposals will be considered by the Summer Institutes and Special Symposia Committee. Proceedings are published by the AMS as volumes in the series *Proceedings of Symposia in Pure Mathematics*.

Deadline for Suggestions: September 1, 1994

1996 AMS-SIAM-SMB Symposium Some Mathematical Questions in Biology

This one-day symposium, sponsored jointly by the AMS, the Society for Industrial and Applied Mathematics (SIAM), and the Society for Mathematical Biology (SMB), is usually held in conjunction with the annual meeting of a biological society closely associated with the topic. Current and recent topics and chairs of organizing committees:

1991—*Theoretical approaches for predicting spatial effects in ecological systems*, **Robert H. Gardner**, Oak Ridge National Laboratories.
1992—*Cell biology*, **Byron Goldstein**, Los Alamos National Laboratory, and **Carla Wofsy**, University of New Mexico.
1993—*Theories for the evolution of haploid-diploid life cycles*, **Mark Kirkpatrick**, University of Texas, Austin.

Proposals will be considered by the AMS-SIAM-SMB Committee on Mathematics in the Life Sciences. Papers from the symposia are published by the AMS as volumes in the series *Lectures on Mathematics in the Life Sciences*.

Deadline for Suggestions: September 1, 1994

1996 AMS-SIAM Summer Seminar in Applied Mathematics

The goal of the Summer Seminar, sponsored jointly by the AMS and the Society for Industrial and Applied Mathematics (SIAM), is to provide an environment and program in applied mathematics in which experts can exchange the latest ideas

and newcomers can learn about the field. Current and recent topics and chairs of organizing committees:
1992—*Exploiting symmetry in applied and numerical analysis*, **Eugene L. Allgower**, **Kurt Georg**, and **Rick Miranda**, Colorado State University.
1993—*The mathematics of tomography, impedance imaging, and integral geometry*, **Eric Todd Quinto**, Tufts University.
1994—*Dynamical systems and probabilistic methods for nonlinear waves*, **Percy Deift**, Courant Institute, **Philip Holmes**, Cornell University, and **David W. McLaughlin**, Princeton University.
1995—*Mathematics of numerical analysis: Real number algorithms*, **Steve Smale**, University of California, Berkeley.

Proposals will be considered by the AMS-SIAM Committee on Applied Mathematics. Proceedings are published by the AMS as volumes in the series *Lectures in Applied Mathematics*.

Deadline for Suggestions: September 1, 1994

1996 Joint Summer Research Conferences in the Mathematical Sciences

These conferences, jointly sponsored by the AMS, the Institute for Mathematical Statistics (IMS), and the Society for Industrial and Applied Mathematics (SIAM), emulate the scientific structure of those held at Oberwolfach and represent diverse areas of mathematical activity, with emphasis on areas currently especially active. Careful attention is paid to subjects in which there is important interdisciplinary activity at present. A one-week or two-week conference may be proposed. Topics for the twelfth series of one-week conferences being held in 1994 are: *Continuous algorithms and complexity*; *Moonshine, the monster, and related topics*; *Multidimensional complex dynamics*; *Markov chain Monte Carlo methods*; *Periodicity and structured homology theories in homotopy theory*; and *Bergman spaces and the operators that act on them.*

Proposals will be considered by the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. If proceedings are published by the AMS they appear as volumes in the series *Contemporary Mathematics*.

Deadline For Suggestions: February 1, 1994

1996 AMS Short Course Series

The AMS Short Courses consist of a series of introductory survey lectures and discussions which take place over a period of two days prior to and during the Joint Mathematics Meetings held in January and August each year. Each theme is a specific area of applied mathematics or mathematics used in the study of a specific subject or collection of problems in one of the physical, biological, or social sciences, technology, or business. Current and recent topics:

Complex analytic dynamics (January 1994), *Wavelets and applications* (January 1993), *New scientific applications of geometry and topology* (January 1992), *Unreasonable effectiveness of number theory* (August 1991), *Probabilistic combinatorics and its applications* (January 1991), *Combinatorial games* (August 1990), *Mathematical questions in robotics* (January 1990).

Proposals will be considered by the Short Course Subcommittee of the Program Committee for National Meetings. Proceedings are published by the Society as volumes in the series *Proceedings of Symposia in Applied Mathematics*, with the approval of the Editorial Committee.

Deadline for Suggestions: Suggestions for the January 1996 course should be submitted by **December 1, 1994**; suggestions for the August 1995 course should be submitted by **July 1, 1994**.

Submit suggestions to: AMS Director of Meetings, P.O. Box 6887, Providence, RI 02940; fax: 401-455-4004; e-mail: `meet@math.ams.org`.

Workshop on Women in Probability

The AMS and the Mathematical Sciences Institute (MSI) at Cornell University will cosponsor a workshop, *Women in Probability*, to be held at Cornell on October 16–18, 1994. **Molly Hahn**, Tufts University, and **Ruth J. Williams**, University of California, San Diego, are the organizers of this workshop. **Cathleen Morawetz**, AMS president, will represent the Society at the workshop, which will begin Sunday morning and end Tuesday at noon.

The core of the workshop features talks on their research by eminent probabilists **Carol E. Bezuidenhout**, University of Rochester; **Jennifer Chayes**, University of California, Los Angeles; **Alison Etheridge**, University of Edinburgh; **Raya Feldman**, University of California, Santa Barbara; **Antonia Foldes**, CUNY, Staten Island; **Cindy Greenwood**, University of California, Berkeley; **Claudia Neuhauser**, University of Wisconsin, Madison; **Vien Nguyen**, Massachusetts Institute of Technology, **Magda Peligrad**, University of Cincinnati; **Marta Sanz**, University of Barcelona, and **Ruth J. Williams**. In addition, anyone attending the workshop may present a contributed talk.

Recent Ph.D.s and finishing graduate students are especially encouraged to prepare a short presentation for this part of the workshop. Other activities include lunchtime discussions and one or two panels on issues of interest to all participants (the exact subjects of the panel discussions will be announced at a later date).

On Sunday evening there will be a dinner for workshop participants at which **Alexandra Bellow**, Northwestern University, has agreed to be the guest speaker.

Some of the aims of the workshop are to publicize good research by women in probability, to provide a forum for networking (in particular, to allow younger women to meet more established probabilists), and to provide a forum for discussion of both the needs and potential for further contributions of women in probability.

It is hoped that as many women in probability as possible will attend. Of course, the conference also will be open to others who wish to attend. There is funding from MSI for some modest travel grants to assist women probabilists, especially young researchers, to attend the workshop. Since it is unlikely that these grants will cover the full cost of attendance at the workshop, participants are encouraged also to seek funding from other sources, such as their home institutions. Participants should note that the workshop will start promptly on Sunday morning, so a Saturday arrival which takes advantage of discounted airfares is highly desirable.

Those wishing to attend the Cornell workshop should send a request for registration materials to `dld8@cornell.edu` or Diana Drake, Mathematical Sciences Institute, 409 College Avenue, Ithaca, New York 14850; phone: 607-255-8005. Information on how to register, how to submit an abstract for a contributed presentation, and how to apply for a travel grant will be sent by return e-mail or return regular mail, as appropriate. The deadline for application for a travel grant is **June 10, 1994**. The deadline for submission of abstracts is **July 1, 1994**. Other questions may be directed to the organizers at `womprob@math.ucsd.edu`.

Mathematical Sciences Meetings and Conferences

THIS SECTION contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete listing of meetings of the Society, and of meetings sponsored by the Society, will be found inside the front cover.

AN ANNOUNCEMENT will be published in the *Notices* if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

IN GENERAL, announcements of meetings and conferences held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the *Notices*, care of the American Mathematical Society in Providence, or electronically to `notices@math.ams.org`.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

EFFECTIVE with the 1990 volume of the *Notices*, the complete list of Mathematical Sciences Meetings and Conferences will be published only in the September issue. In all other issues, only meetings and conferences for the twelve-month period following the month of that issue will appear. As new information is received for meetings and conferences that will occur later than the twelve-month period, it will be announced at the end of the listing in the next possible issue. That information will not be repeated until the date of the meeting or conference falls within the twelve-month period.

1994

1994–1995. **Mittag-Leffler Institute's Academic Program for 1994–1995: Statistical Mechanics and Stochastic Analysis**, Mittag-Leffler Institute, Djursholm, Sweden. (Dec. 1993, p. 1444)

June 1994

First Workshop on Scientific Information concerning Education, Camagüey, Cuba. (Mar. 1994, p. 246)

1–4. **International Conference on Differential Equations and Applications to Biology and to Industry**, Harvey Mudd College, Claremont, CA. (Dec. 1993, p. 1448)

1–7. **1994 Barcelona Conference on Algebraic Topology**, Sant Feliu de Guixols (near Barcelona, Spain). (Nov. 1993, p. 1256)

2–5. **Colloque Pierre Eymard, Colloque tournant d'Analyse Harmonique**, Université de Nancy, France. (Mar. 1994, p. 246)

2–19. **Constructivist Methods in Undergraduate Math Teaching: Calculus**, Purdue University, West Lafayette, Indiana. (December 1993, p. 1448)

3–4. **Praha-Chemnitz-Torun Algebra Symposium**, Charles University, Faculty of Mathematics and Physics, Prague, Czech Republic. (Jan. 1994, p. 54)

5–11. **The Navier-Stokes Equations: Theory and Numerical Methods**, Oberwolfach, Germany. (Jul./Aug. 1993, p. 713)

5–11. **Workshop on Harmonic Analysis, Oscillatory Integrals, and Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jan. 1994, p. 54)

6–10. **Applied and Industrial Mathematics**, University of Linköping, Linköping, Sweden. (Nov. 1993, p. 1256)

6–10. **Formes Quadratiques et Groupes Algebraiques Lineaires**, Marseille, France. (Jan. 1994, p. 54)

6–11. **International Conference on Algebra and Analysis in Commemoration of the Centennial of the Birth of Eminent Russian Mathematician N.G. Chebotarev**, Kazan, Tatarstan. (Dec. 1993, p. 1449)

7–11. **AMS Symposium in Research Mathematics on Quantization and Nonlinear Wave Equations**, Massachusetts Institute of Technology, Cambridge, MA.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

8–10. **Canadian Society for the History and Philosophy of Mathematics**, Calgary, Alberta. (Feb. 1994, p. 140)

9–11. **Sixth Lehigh University Geometry/Topology Conference**, Bethlehem, PA (Jan. 1994, p. 54)

9–19. **Constructivist Methods in Undergraduate Math Teaching: Abstract Algebra**, Purdue University, West Lafayette, IN. (Dec. 1993, p. 1449)

11–13. **Canadian Mathematical Society Summer Meeting**, University of Alberta, Edmonton, Alberta, Canada. (Mar. 1994, p. 246)

11–July 6. **Joint Summer Research Conferences in the Mathematical Sciences**, Mount Holyoke College, South Hadley, Massachusetts. (Dec. 1993, p. 1449)

* 12–15. **Fourth Conference on Situation Theory and its Applications**, Saint Mary's College of California, Moraga, CA.

TOPIC: Information-oriented approaches to logic, language, and computation.

PROGRAM: A special feature is a symposium on visual reasoning, organized by J. Barwise and J. Etchemendy. Preconference instructional workshops from June 8 to June 11 will cover situation theory (L. Moss), situation semantics (S. Peters), and teaching logic with hyperproof (J. Barwise and J. Etchemendy).

INFORMATION: `devlin@stmarys-ca.edu`.

12–18. **Nichtlinearitaten vom Hysteresistyp**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

13–17. **Advanced Topics in Applied Mathematics and Theoretical Physics**, CIRM, Marseille, France. (Feb. 1994, p. 140)

13–18. **International Conference on Logic Planning**, Santa Margherita Ligure, Italy. (Feb. 1994, p. 140)

13–22. **Dynamical Systems**, Villa La Querceta, Montecatini Terme (PT). (Feb. 1994, p. 140)

13–14. **The 1994 IEEE Workshop on Fault-Tolerant Parallel and Distributed Systems**, College Station, TX. (Jan. 1994, p. 54)

13–17. **Fifth International Conference on Hyperbolic Problems: Theory, Numerical**

Methods, and Applications, Stony Brook, NY. (May/Jun. 1992, p. 497)

13–17. **European Conference on Elliptic and Parabolic Problems**, Pont-à-Mousson, France. (May/Jun. 1993, p. 514)

Summer 1994. **Summer Regional Centers–TRANSIT**, Ohio State University, Columbus, OH. (Oct. 1992, p. 951)

13–17. **IMA Workshop on Classical & Modern Branching Processes**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

13–18. **Thirty Years after Sharkovskii's Theorem—New Perspectives**, Murcia, Spain. (Dec. 1993, p. 1449)

15–18. **Fifth SIAM Conference on Applied Linear Algebra**, Snowbird, Utah. (Jan. 1994, p. 54)

15–19. **Symplectic Topology**, University of Georgia, Athens, Georgia. (Apr. 1994, p. 377)

15–24. **Canadian Mathematical Society Annual Seminar. Representations of Groups: Finite, Algebraic, Lie, and Quantum**, Banff, Alberta, Canada. (Dec. 1993, p. 1449)

16–18. **Western Section**, University of Oregon, Eugene, Oregon.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

*17. **ICLP '94 Post-conference Workshop on Proof-theoretical Extensions of Logic Programming**, S. Margherita Ligure, Italy.

TOPICS: Proof-theoretic foundations: cut elimination, negation-as-failure, equational theories, program completion, reasoning by induction; partial inductive definitions; linear logic; constructive, modal and temporal logics, many-valued logics, higher-order logics, and type-theoretic approaches. Languages: Elf, GCLA, Isabelle, lambda Prolog, LO!, Lolli, and ACL. Applications: program synthesis, transformations and equivalence, program termination, unification theory and constraints; theorem proving; programming language implementations; modularity, and knowledge representation.

ORGANIZING COMMITTEE: L.-H. Eriksson, R. Dyckhoff, A. Momigliano, and M. Ornaghi.

INFORMATION: A. Momigliano, Dept. of Philosophy, Carnegie Mellon Univ., Pittsburgh, PA 15213-3890; tel: +1-412-268-8047; fax: +1-412-268-1440; e-mail: `mobile@lcl.cmu.edu`.

17–18. **Conference in Honor of L.D. Berkovitz**, Purdue University, West Lafayette, IN. (Feb. 1994, p. 140)

INFORMATION: Phone number for H. T. Banks was listed incorrectly and should be 919-515-3968.

18–19. **IMS Workshop on Directions in Sequential Analysis**, Chapel Hill, NC. (Jan. 1994, p. 55)

*18–21. **Recursion Theory Workshop**, Uppsala University, Uppsala, Sweden.

INVITED SPEAKERS: T. Slaman (U.S.A.), G. Sacks (U.S.A.), Y. Ershov (Russia), B. Cooper (Gr. Brit.), J. Remmel (U.S.A.), E. Boerger (Italy), H. Schwichtenberg (Germany), J. Tucker (Wales), L. Blum (U.S.A.), K. Ambos-Spies (Germany), P. Clote (U.S.A.), S. Friedman (U.S.A.), D. Normann (Norway), P. Odifreddi (Italy), T. Millar (U.S.A.), S. Simpson (U.S.A.), H. Woodin (U.S.A.), D. Cenzer (U.S.A.), R. Shore (U.S.A.), and R. Soare (U.S.A.).

INFORMATION: E. Griffor or V. Stoltenberg-Hansen, Dept. of Math., Uppsala Univ., Box 480, S-751 06 Uppsala, Sweden; tel: 46-18-183222; fax: 46-18-183201; e-mail: `griffor@math.uu.se`.

19–21. **Fourth International Workshop on Meta-programming in Logic (META '94)**, Pisa, Italy. (Feb. 1994, p. 140)

19–25. **Quantenmechanik von Vielteilchen Systemen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

19–25. **Integrable Systems from a Quantum Point of View**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

20–24. **Probabilités Quantiques**, CIRM, Marseille, France. (Jan. 1993, p. 64)

20–24. **IMA Workshop on Mathematics in Manufacturing Logistics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Sep. 1993, p. 927)

20–24. **Probabilites Quantiques**, Marseille, France. (Jan. 1994, p. 55)

20–24. **Les journées mathématiques de Cergy-Pontoise**, Université de Cergy-Pontoise, France. (Apr. 1994, p. 377)

20–25. **Third World Congress of the Bernoulli Society for Mathematical Statistics and Probability and the 57th Annual Meeting of the Institute of Mathematical Statistics**, Chapel Hill, NC. (Dec. 1993, p. 1449)

20–30. **Scale Invariance, Interfaces and Non-Equilibrium Dynamics**, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK. (Mar. 1994, p. 247)

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

INFORMATION: Donna Salter, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

20–July 1. **Miniworkshop on Submicron Dynamics**, Trieste, Italy. (Jan. 1994, p. 55)

21–24. **Conference on Computer-aided Verification**, Stanford U., Stanford, CA. (Feb. 1994, p. 141)

21–24. **NASECODE X: The Tenth International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits**, Dublin, Ireland. (Jan. 1994, p. 55)

22–25. **Seventh SIAM Conference on Discrete Mathematics**, Albuquerque, NM. (Sep. 1993, p. 927)

22–26. **Eighteenth Symposium on Real Analysis**, University of Virginia, Charlottesville, VA. (Dec. 1993, p. 1450)

23–25. **Monte Carlo and Quasi-Monte Carlo Methods in Scientific Computing**, University of Nevada, Las Vegas, Nevada. (Apr. 1994, p. 377)

23–July 1. **International Conference on Abelian Groups and Modules**, University of Padova, Padova, Italy. (Dec. 1993, p. 1450)

24–25. **Third Conference on the Teaching of Calculus**, University of Michigan, Ann Arbor. (Mar. 1994, p. 247)

*24–25. **Summer Mathematics Symposium on Undergraduate Mathematics and Mathematical Modeling**, University of Wisconsin, La Crosse campus.

PROGRAM: A forum for regional mathematicians and mathematics educators to meet and discuss their experiences, successes, and ideas in mathematical modeling and improving undergraduate mathematics education.

KEYNOTE SPEAKERS: R. Askey, Univ. of Wisconsin, Madison, and R. Hodgson, Montana State Univ. (SIMMS Project).

INFORMATION: Contributed paper sessions are also scheduled. For further information call H. Skala, tel: 608-785-6614; or C. Schelin, tel: 608-785-8218.

24–27. **Workshop on Wavelets, Filter Banks, and Applications**, Wellesley, MA. (Feb. 1994, p. 141)

*25–29. **Art and Mathematics Conference (AM94)**, SUNY, Albany, NY.

INFORMATION: N. Friedman, Dept. of Math., SUNY, Albany, NY 12222; tel: 518-442-4621; fax: 518-442-4731; e-mail: `artmath@math.albany.edu`.

25–July 2. **Symposium on Diophantine Problems in Honor of Wolfgang Schmidt's 60th Birthday**, Boulder, Colorado. (May/Jun. 1993, p. 514)

26–30. **Conference on Diffusion Theory and Analysis**, Northwestern University, Evanston, IL. (Apr. 1994, p. 378)

26–July 1. **Calculus in a Real and Complex World**, University of Massachusetts, Amherst, MA. (Apr. 1994, p. 378)

26–July 2. **Graphentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

26–July 2. **Inverse Problems**, Lake St. Wolfgang, Austria. (May/Jun. 1993, p. 514)

27–July 1. **Logique et Informatique**, CIRM, Marseille, France. (Feb. 1994, p. 141)

27–July 2. **Convex and Discrete Geometry**, Bydgoszcz, Poland. (Dec. 1993, p. 1450)

27–July 2. **1994 International Conference and Summer School, "Progress in Inverse Spectral Geometry"**, Huddinge (Stockholm), Sweden. (Apr. 1994, p. 378)

28–July 1. **Structure in Complexity Theory, Ninth Annual IEEE Conference**, Amsterdam, The Netherlands. (Nov. 1993, p. 1256)

*29–July 1. **4th International Conference on Computer Aided Design in Composite Material Technology**, Southampton, UK.

PROGRAM: The conference will focus on all aspects of composite material technology covering a wide and nonexhaustive variety of topics including two new areas on numerical simulation techniques and strength and stiffness prediction.
ORGANIZING COMMITTEE: W.R. Blain (Wessex Inst. of Technology), W.P. DeWilde (Vrije Universiteit Brussels), and C.A. Brebbia (Wessex Inst. of Technology).
INFORMATION: Susi King, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, SO4 2AA, UK; tel: 44 (0)703 293223; fax: 44 (0)703 292853; e-mail `CMI@uk.ac.rl.ib`.

July 1994

2–8. **Fourth Conference of the Canadian Number Theory Association**, Dalhousie University, Halifax, Nova Scotia, Canada. (Sep. 1993, p. 927)

3–7. **Third International Congress on Industrial and Applied Mathematics**, Hamburg, Germany. (Apr. 1994, p. 378)

*3–9. **Partial Differential Equations**, Holzhau/Erzgebirge, Germany.

TOPICS: Microlocal analysis, pseudo-differential operators, manifolds with singularities, aspects in differental geometry and index theory, operator theory and operator algebras, stochastic spectral analysis, Feller operators, semi-classical methods and scattering theory.
ORGANIZING COMMITTEE: S. Albeverio (Bochum), L. Boutet de Monvel (Paris), M. Demuth (Potsdam), P.B. Gilkey (Eugene), B. Gramsch (Mainz), B. Helffer (Paris), S.T. Kuroda (Tokyo), B.-W. Schulze (Potsdam).
PROGRAM: Plenary talks (35-minute talks) will take place in the morning and afternoon. Because over 100 participants are expected, it is impossible to offer everyone the possibility of giving a talk. Those invited to speak will receive notice separately.
INFORMATION: B.-W. Schulze; tel: (0331) 977-1269; and fax: (0331) 977-1440.

3–9. **Analysis und Geometrie Singulärer Räume**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

4–7. **International Conference on Nonlinear Dynamics and Pattern Formation in the Natural Environment**, Amsterdam, The Netherlands. (Dec. 1993, p. 1450)

4–7. **Ninth Annual IEEE Symposium on Logic in Computer Science**, Paris, France. (Oct. 1993, p. 1087)

4–8. **12th Australian Statistical Society Conference**, Monash University, Clayton, Victoria. (Apr. 1994, p. 378)

4–8. **Annual Meeting of the Australian Mathematical Society**, Armidale, New South Wales, Australia. (Mar. 1994, p. 247)

4–8. **Arrangements d'Hyperplans**, CIRM, Marseille, France. (Feb. 1994, p. 141)

4–8. **International Conference on Computer Aided Geometric Design (CAGD)**, Penang, Malaysia. (Jul./Aug. 1993, p. 713)

4–8. **Thirty-eighth Annual Meeting of the Australian Mathematical Society**, University of New England in Armidale, Australia. (Oct. 1993, p. 1087)

4–12. **Transcendental Methods in Algebraic Geometry**, Grand Hotel San Michele, Cetraro (CS). (Feb. 1994, p. 141)

4–15. **Second International Summer School in Logic for Computer Science**, University of Chambery (High Alps, France). (Apr. 1994, p. 379)

4–29. **Miniworkshop on Quantum Phase Transitions**, Trieste, Italy. (Jan. 1994, p. 55)

5–9. **Twenty-fourth National Conference on Geometry and Topology (CNGT 24)**, University of Timişoara, Romania. (Jul./Aug. 1993, p. 713)

*5–10. **Summer Workshop on the Mathematical Theory of Phase Transitions**, University of Sussex, UK.

PROGRAM: The meeting will concentrate on the mathematical and numerical analysis of phase transition problems arising in the physical sciences. Topics will include crystal growth, phase field equations, geometric motion of phase boundaries, Cahn-Hilliard equations, Ginzburg-Landau equations, and superconductivity.
ORGANIZERS: C.M. Elliott and Q. Tang.
SPEAKERS: G. Caginalp, P. Fife, J.R. Ockendon, H.M. Soner, and C. Verdi.
INFORMATION: C. Coles, Centre for Mathematical Analysis and Its Applications, School of Mathematical and Physical Sciences, Univ. of Sussex, Brighton BN1 9QH; tel: 0273 678108; e-mail: `cmaia@sussex.ac.uk`.

5–22. **Conference on Differential and Difference Equations and Recent Developments in Population Biology**, University of Wyoming, Laramie, WY. (Nov. 1993, p. 1257)

5–29. **IMA Summer Program on Molecular Biology**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1993, p. 415)

9–14. **Conference on Differential Geometry**, Katholieke Universiteit Leuven and Brussel (Belgium). (Feb. 1994, p. 141)

7–23. **XXIVème Ecole D'été de Calcul des Probabilites**, Saint-Flour (Cantal), France. (Mar. 1994, p. 248)

10–13. **Second Conference on Mathematics and Computers in Sport**, Gold Coast, Queensland, Australia. (Mar. 1994, p. 248)

10–16. **Freie Randwertprobleme**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

10–16. **Euroconference: Combinatorial Geometry**, Anogeia, Crete, Greece. (Jan. 1994, p. 56)

10–20. **Third Souslin Conference**, Saratov, Russia. (Feb. 1994, p. 142)

10–30. **The Park City/Institute for Advanced Study Mathematics Institute**, Park City, Utah. (Jan. 1994, p. 56)

*11–13. **Introduction to Theorem Proving, Using "Isabelle"**, University of Cambridge, UK.

PROGRAM: The aim of the course is to introduce participants to the Isabelle system, developed at Cambridge and used since 1986 in research establishments. Isabelle has built-in support for several logics, including first-order logic (FOL), higher-order logic (HOL), Zermelo-Fraenkel set theory (ZF), and extensional Constructive Type Theory (CTT).
INFORMATION: E-mail: `Larry.Paulson@cl.cam.ac.uk`.

11–13. **AEMC94–First Biennial Engineering Mathematics Conference**, Melbourne, Victoria, Australia. (Mar. 1994, p. 248)

11–14. **First International Conference on Temporal Logic**, Gustav Stresemann Institut, Bonn, Germany. (Feb. 1994, p. 142)

*11–14. **Logical Foundations of Computer Science (LFCS '94)**, St. Petersburg, Russia.

TOPICS: Complexity of formal systems, constructive mathematics in computer science, denotational semantics of programs, descriptive complexity, dynamic logic, concurrent and distributed computational models, foundations of logic programming, generalized computability, lambda and combinatory calculi, logical foundations of database theory, logics for knowledge, modal and temporal logics, program verification, teaching computer science and logic, and type theory in programming.

PROGRAM COMMITTEE: A. Nerode (chair), S. Abiteboul, S.I. Adian, S.N. Artemov, H. Barendregt, A. Blass, G. Jager, V. Marek, Yu.V. Matijasevich, V.A. Nepomnyaschy, V.P. Orevkov, A.A. Razborov, J. Remmel, A. Scedrov, M.A. Taitslin, and M. Vardi.
INFORMATION: (1) LFCS '94 Secretariat, Laboratory of Mathematical Logic, Steklov Institute of Math., 27 Fontanka, St. Petersburg191011, Russia; tel:+7 812 311-4392; fax: +7 812 310-5377; and e-mail: lfcs@sovam.com. (2) LFCS '94 Mathematical Sciences Inst., Cornell Univ., 407 College Ave., Ithaca, NY 14850; tel: 607-255-7752; fax: 607-255-8005; and e-mail: lfcs@msiadmin.cit.cornell.edu.

11–15. **Analyse-non Standard**, CIRM, Marseille, France. (Feb. 1994, p. 142)

11–15. **Fourteenth IMACS World Congress on Computational and Applied Mathematics**, Georgia Institute of Technology, Atlanta, GA. (Oct. 1992, p. 951)

11–15. **The First International Derive Conference**, Plymouth, UK. (Dec. 1993, p. 1450)

*11–15. **Workshop on Algebraic and Number Theoretic Aspects of Ergodic Theory**, Mathematics Research Centre, University of Warwick, UK.

INFORMATION: E. Shiels, Mathematics Research Centre, Univ. of Warwick, Coventry CV4 7AL, UK; fax: (0203) 523548.

11–16. **International Workshop on Quantum Communications and Measurement**, University of Nottingham, England. (Mar. 1994, p. 248)

11–22. **SMS-NATO ASI: Topological Methods in Differential Equations and Inclusions**, Université de Montréal, Montréal, Canada. (Dec. 1993, p. 1451)

12–15. **Theoretical Models in Biological Systems**, Trieste, Italy. (Jan. 1994, p. 56)

14–16. **Increasing the Flow of Women into Mathematics**, University of California at Berkeley. (Apr. 1994, p. 379)

14–18. **LFCS'94: Logic at St. Petersburg, a Symposium on Logical Foundations of Computer Science**, St. Petersburg, Russia. (Jul./Aug. 1993, p. 714)

16–21. **Fifth International Conference on Logic Programming and Automated Reasoning (LPAR '94)**, Kiev, Ukraine. (Feb. 1994, p. 142)

17–23. **Conférence Internationale de Topologie**, CIRM, Marseille, France. (Jan. 1993, p. 64)

17–23. **Algebraische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

17–23. **Workshop on Harmonic Analysis and Elliptic Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 714)

17–23. **Euroconference: Actions of Lie Groups and Discrete Subgroups on Manifolds**, Anogeia, Crete, Greece. (Jan. 1994, p. 56)

18–22. **CIMNS International Colloquium on Nonstandard Mathematics in Memory of Abraham Robinson**, Universities of Aveiro and Beira Interior, Portugal. (Feb. 1994, p. 142)

18–22. **Sixth International Conference on Fibonacci Numbers and Their Applications**, Washington State University, Pullman, WA. (Jul./Aug. 1993, p. 714)

18–22. **Conference Internationale de Topologie**, Marseille, France. (Jan. 1994, p. 56)

*18–22. **Workshop on Lattice Dynamics, Statistical Mechanics, and Ergodic Theory**, Mathematics Research Centre, University of Warwick, United Kingdom.

INFORMATION: E. Shiels, Mathematics Research Centre, Univ. of Warwick, Coventry CV4 7AL, UK; fax: (0203) 523548.

18–22. **Was There Really a Big Bang? A Case Study in Scientific Methodology**, Massachusetts Institute of Technology, Cambridge, MA. (Apr. 1994, p. 379)

18–23. **XIth International Congress of Mathematical Physics (ICMP)**, Centre de Conférences of UNESCO and the Sorbonne, Paris, France. (Apr. 1994, p. 379)

*18–24. *Mathmatica* **in the Mountains**, Leadville, CO.

COURSE DESCRIPTION: The course is aimed at teachers of mathematics and other scientific subjects, for whom *Mathematica* will be an extremely useful tool. Participants should have some experience with *Mathematica*. The emphasis will be on calculus, though issues and examples related to a variety of undergraduate courses (number theory, numerical analysis, differential equations, discrete mathematics, modern algebra) will be discussed.
INSTRUCTOR: S. Wagon, Macalester College.
INFORMATION: For information about the course: S. Wagon; tel: 303-468-0977; e-mail: 71043.3326@compuserve.com. For all other matters, including registration: P. McKeever; e-mail: 73173.1245@compuserv.com.

18–29. **Fifth Workshop of Stochastic Analysis of Oslo-Silivri**, Silivri, Istanbul, Turkey. (Oct. 1993, p. 1087)

*19–21. **9th International Conference on Artificial Intelligence in Engineering**, Pennsylvania State, Great Valley, PA.

OBJECTIVES: The purpose of this conference is to provide an international forum for the presentation of work on the state-of-the-art on applications of artificial intelligence to engineering problems.
INFORMATION: Sue Owen, Conference Secretariat-AIENG 94, Ashurst Lodge, Ashurst, Southampton, SO4 2AA UK; tel: +44 (0) 703 293223; fax: +44 (0) 703 292853; e-mail: CMI@uk.ac.rl.ib.

*20–21. **Bar-Ilan Workshop and Seminar on Applied Constraint Reasoning**, Bar-Ilan Univ., Ramat-Gan, Israel.

PROGRAM: The workshop and seminar will be of interest especially to those working in AI and applications with the emphasis being on satisfiability, reasoning and search algorithms from a real-world point of view. The orientation of the meeting will be informal in order to promote interaction and stimulate cooperative research.
GUEST LECTURERS: B. Nadel (Wayne State, Ford Motor Co.) and B. Faltings (Ecole Polytechnique Federalle de Lausanne).
INFORMATION: M. Golumbic, Computer Science Research Inst., Bar-Ilan Univ., Ramat-Gan, Israel; e-mail research@bimacs.bitnet or research@bimacs.cs.biu.ac.il.

20–22. **International Symposium on Symbolic and Algebraic Computation, ISSAC '94**, St. Catherine's College, Oxford, UK. (Jan. 1994, p. 56)

20–30. **Third Souslin Conference**, Saratov, Russia. (Jul./Aug. 1993, p. 714)

21–30. **1994 ASL European Summer Meeting (Logic Colloquium '94)**, Universite d'Auvergne, Clermont-Ferrand, France. (Feb. 1994, p. 142)

24–30. **Complex Geometry: Moduli Problems**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

25–29. **Représentation des Groupes Reductifs *p*-adiques**, CIRM, Marseille, France. (Nov. 1992, p. 1122)

25–29. **1994 SIAM Annual Meeting**, San Diego, CA. (Sep. 1993, p. 927)

25–29. **Conference on Evolution Equations**, University of Strathclyde, Glasgow, Scotland. (Dec. 1993, p. 1451)

25–29. **European Colloquium of Category Theory (ECCT)**, Tours, France. (Jan. 1994, p. 56)

25–30. **Colloquium on Differential Geometry**, Mathematical Institute of the University of Debrecen, Hungary. (Mar. 1994, p. 248)

26–29. **Algebraic Combinatorics Conference in Honor of Adriano M. Garsia**, Taormina, Sicily, Italy. (Apr. 1994, p. 380)

26–30. **Seventh International Colloquium on Differential Geometry**, Universidade de Santiago de Compostela, Santiago de Compostela, Spain. (Dec. 1993, p. 1451)

26–30. **Algebraic K-Theory**, Université Paris VII, Paris, France. (Jan. 1994, p. 56)

27–30. **Inverse Problems in Engineering Sciences (IPES–94)**, Osaka Institute of Technology, Osaka, Japan. (Apr. 1994, p. 380)

27–August 1. **International Conference on Commutative Algebra (A Satellite Conference of ICM 94, Zürich)**, Universität Osnabrück, Standort Vechta, Germany. (Dec. 1993, p. 1451)

28–August 1. **Workshop on Harmonic Maps and Curvature Properties of Submanifolds**, University of Leeds, England. (Dec. 1993, p. 1451)

* 31–August 3. **Fourteenth International Conference on Critical Thinking and Educational Reform**, Sonoma State University, Rohnert Park, CA.

THEME: The conference theme for this year is "Restructuring the Future: Critical Thinking Tactics That Work in the Classroom and on the Job".
INFORMATION: Center for Critical Thinking, Sonoma State University, Rohnert Park, CA 94928; tel: 707-664-2940; fax: 707-664-4101; e-mail: CCT@Sonoma.EDU.

31–August 4. **TEX Users Group Annual Meeting**, University of California, Santa Barbara, CA. (Feb. 1994, p. 143)

31–August 6. **Mechanics of Materials**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

August 1994

1–5. **Third World Congress on Computational Mechanics (WCCM III)**, Chiba, Japan. (May/Jun. 1992, p. 497)

1–19. **IMA Course on Mathematical Modeling for Teachers**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Dec. 1993, p. 145)

* 3–11. **The International Congress of Mathematicans 1994**, Zürich, Switzerland. (Mar. 1994, p. 249)

NEW INFORMATION: "Lorentzian Geometry and Applications" during the ICM '94. For further information contact organizers: K. Marathe, e-mail: KBM@SCI.BROOKLIN.CUNY.EDU; J. Beem, e-mail: MathJKB@mizzou1.missouri.edu; or K.L. Duggal, e-mail: YQ8@ucc.uwindsor.ca.

7–13. **Effiziente Algorithmen**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

12–20. **1994 Summer Workshop-Conference on Classical and Quantum Geometry of Homogeneous Spaces**, International Sophus Lie Centre, Moscow. (Oct. 1993, p. 1087)

13–17. **Third Colloquium on Numerical Analysis**, Plovdiv, Bulgaria. (Apr. 1993, p. 416)

13–19. **International Conference on Potential Theory (ICPT '94)**, Kouty, Czech Republic. (Dec. 1993, p. 1452)

14–17. **1994 International Workshop on Complex Structures and Vector Fields**, Bulgaria. (Mar. 1994, p. 249)

14–20. **Nonlinear Evolution Equations**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

14–21. **International Conference on Functional Differential Equations and Applications**, Moscow, Russia. (Nov. 1993, p. 1257)

14–27. **NATO Advanced Study Institute on "Finite and Locally Finite Groups"**, Bosphorous University, Istanbul, Turkey. (Nov. 1993, p. 1257)

15–17. **Mathfest**, University of Minnesota, Minneapolis, MN (including the summer meetings of the AMS, AWM, MAA, and PME).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

15–18. **Tenth Summer Conference on General Topology and Applications**, Free University, Amsterdam, The Netherlands. (Nov. 1993, p. 1258)

15–19. **Fifteenth International Symposium on Mathematical Programming**, University of Michigan, Ann Arbor, MI. (May/Jun. 1993, p. 515)

15–19. **Fourth Conference of the International Linear Algebra Society (ILAS)**, Erasmus University, Rotterdam, The Netherlands. (Dec. 1993, p. 1452)

15–19. **1994 International Conference on Parallel Processing**, The Pennsylvania State University, University Park, PA. (Jan. 1994, p. 57)

15–26. **Advanced Workshop on Algebraic Geometry**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 714)

16–20. **ICMI-China Regional Conference on Mathematics Education**, Shanghai, China. (Jul./Aug. 1993, p. 714)

16–26. **Workshop on Representations of Algebras and Related Topics (to coordinate with 7th International Conference on Representations of Algebras (see August 22–26)**, Instituto de Matemáticas UNAM, Mexico. (Apr. 1994, p. 381)

* 17–20. **Second Upper Michigan Combinatorics Workshop on Codes, Designs, and Geometries**, Michigan Technological University, Houghton, MI.

SPONSORS: The National Science Foundation, with additional support from The Institute for Combinatorics and its Applications.
ORGANIZERS: A. Baartmans, D. Kreher, V. Tonchev.
INVITED SPEAKERS: E. Assmus (Lehigh Univ.), C. Colbourn (Univ. of Waterloo, Canada), J. Key (Clemson Univ.), C. Lam (Concordia Univ., Canada), S. Magliveras (Univ. of Nebraska), V. Pless (Univ. of Illinois), D. Street (Univ. of New S. Wales, Australia), and J. Thas (Univ. of Ghent, Belgium).
INFORMATION: M.C. Graham, Dept. of Mathematical Sciences, Michigan Technological Univ., 1400 Townsend, Houghton, MI 49931-1295; tel: 906-487-2068; e-mail mcgraham@mathlab.mtu.edu.

18–23. **Fifth Colloquium on Differential Equations**, Plovdiv, Bulgaria. (Apr. 1993, p. 416)

18–25. **Third International Conference on Group Theory**, Pusan, Republic of Korea. (Nov. 1993, p. 1258)

20–26. **International Conference on Rings and Radicals**, Shijiazhuang, China. (Mar. 1993, p. 287)

20–28. **International Conference on Algorithms in Algebra, Geometry, and Combinatorics**, near Nizhny Novgorod, Russia. (Feb. 1994, p. 143)

21–26. **3rd International Conference on Numerical Methods and Applications**, Sofia, Bulgaria. (Apr. 1994, p. 381)

21–27. **Gruppen und Geometrien**, Oberwolfach, Federal Republic of Germany.

* 21–September 3. **Formation and Interactions of Topological Defects**, Newton Institute, Cambridge, UK.

PROGRAM: The meeting will discuss and explore the recent advances in the theory of topological defects and their role in condensed matter physics and cosmology.
ORGANIZING COMMITTEE: A.-C. Davis (Cambridge), R.H. Brandenberger (Providence), G.F. Mazenko (Chicago), and H.R. Trebin (Stuttgart).
LECTURERS: F. Bouchet (Paris), A. Bray (Manchester), B. Carter (Paris), R. Durrer (Zurich), N. Goldenfeld (Urbana), T. Kibble (London), M. Kléman (Paris), H. Kleinert (Berlin), N. Manton (Cambridge), G. Mazenko (Chicago), R. Rivers (London), J. Toner (Yorktown), N. Turok (Princeton), B. Yurke (Murray Hill), and W. Zurek (Los Alamos).
INFORMATION: F.J. Marsters, Newton Institute, 20 Clarkson Rd., Cambridge CB3 0EH, UK; e-mail: i.newton@newton.cam.ac.uk.

22–25. **Second Summer Conference, Numerical Modelling in Continuum Mechanics (Theory, Algorithms, Applications)**, Charles University Prague, Czech Republic. (Feb. 1994, p. 143)

22–26. **7th International Conference on Representations of Algebras (ICRA VII)**, Cocoyoc, Mexico. (Apr. 1994, p. 381)

22–26. **2nd International Congress on Mathematica as an Educational and Research**

Tool, Universidad Autonoma de San Luis Potosi, San Luis Potosi, Mexico. (Apr. 1994, p. 381)

22–26. **Sixth Conference on Numerical Methods in Hungary**, Miskolc University, Miskolc, Hungary. (Sep. 1993, p. 928)

*23–26. **HCI '94: People and Computers**, University of Glasgow, Glasgow, UK.

PROGRAM: This is an annual conference bringing together researchers and practioners from industry and academia who are working to improve the effectiveness of computers and people.
INFORMATION: Electronic mail: HCI94@dcs.glasgow.ac.uk.

26–28. **1994 Annual Meeting of the Australasian Association for Logic**, U. of Otago, Dunedin, New Zealand. (Feb. 1994, p. 144)

27–28. **Conference on the History of Mathematics in Honor of Boris Rosenfeld**, Pennsylvania State University, University Park, PA. (Dec. 1993, p. 1452)

*27–September 3. **8th Banff Higher Order Workshop (Logics for Concurrency: Structure vs. Automata)**, The Banff Centre, Banff, Alberta, Canada.

PROGRAM: Based on the theme of logics for concurrency, this year's workshop is mainly intended for graduate students and researchers already interested in concurrency theory and/or temporal logics who want a kick-start into selected central themes.
LECTURERS: S. Abramsky, E.A. Emerson, Y. Hirshfeld, F. Moller, C. Stirling, and M.Y. Vardi.
COST: $1,200 (Can) includes food, accommodations, and taxes.
INFORMATION: G. Birtwistle, Dept. of Computer Science, Univ. of Calgary, Calgary T2N 1N4, Canada; tel: +1 403-220-6055; fax: +1 403-284-4707; the Internet: graham@cpsc.ucalgary.ca.

28–September 3. **Komplexe Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

*28–September 3. **Second Order Logic**, Poland.

EXPECTED PARTICIPANTS: M. Brown, X. Caicedo, H.-D. Ebbinghaus, J. Flum, H. Herre, J. Hintikka, A. Ivanov, M. Krynicki, D. Leivant, Z. Mijailovic, M. Mostowski, A. Pinus, Z. Ratajczyk, S. Shapiro, M. van Lambalgen, and M. Zawadowski.
ORGANIZERS: M. Krynicki and M. Mostowski.
INFORMATION: M. Krynicki, Instytut Matematyki, Uniwersytet Warszawski, 01-097 Warszawa, Banacha 2, Poland; e-mail: order2nd@plearn.bitnet. Communication by e-mail is preferred. The deadline for submitting a proposal to give a talk is May 31, 1994.

29–September 2. **L'arithmetique des Courbes de Genre Deux.**, CIRM, Marseille, France. (Feb. 1994, p. 144)

29–September 2. **Mathematical Modelling and Computational Methods "Modelling 94"**, Prague, Czech Republic. (Mar. 1994, p. 250)

September 1994

September 1994. **Suslin Jubilee International Conferences**, Suslin Foundation, Russia. (Oct. 1993, p. 1088)

Fall 1994. **Workshop on Exterior Differential Systems and Applications**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 57)

Fall 1994. **Workshop on Geometry of Noncompact Manifolds**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 57)

4–10. **Topologie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

*5–7. **6th IMA Conference on the Mathematics of Surfaces**, Brunel University, London, UK.

INFORMATION: R. Martin, e-mail: ralph@cm.cf.ac.uk.

5–8. **4th European Workshop on Logics in AI (JELIA '94)**, York, UK. (Apr. 1994, p. 382)

5–8. **ECCOMAS-Second European Computational Fluid Dynamics Conference**, Stuttgart, Germany. (Dec. 1993, p. 1452)

*5–9. **Meeting on Quaternionic Structures in Mathematics and Physics**, Trieste, Italy.

PROGRAM: The purpose of the meeting is to bring together scientists from different areas of mathematics and physics working in the field of quaternionic structures. New results in the theory of quaternionic manifolds together with recent progress in Clifford analysis and supersymmetric theories will be presented.
INFORMATION: R. Sain, Laboratorio Interdisciplinare SISSA, Strada Costiera, 11, 34014 Trieste (I); tel: +39 40 224160; fax: +39 40 224163; e-mail: PONTECORVO@TSMI19.SISSA.IT.

5–9. **IX Brazilian Meeting of Topology**, Universidade Federal Fluminense, Instituto de Matematica, Niteroi, Rio de Janeiro, Brazil. (Jan. 1994, p. 57)

5–10. **Analyse Numérique des Polynômes Orthogonaux**, CIRM, Marseille, France. (Feb. 1994, p. 144)

6–8. **International Conference on Parallel Processing: CONPAR 94-VAPP VI**, Linz, Austria. (Oct. 1993, p. 1088)

6–10. **8th International Conference of the European Consortium for Mathematics in Industry**, University of Kaiserslautern, Germany. (Apr. 1994, p. 382)

*7–9. **1st International Conference on Constraints in Computational Logics (CCL)**, Munich, Germany.

TOPICS: CCL covers theoretical and practical issues in the direction of combining and extending programming paradigms preferably (but not exclusively) by using constraints.
INVITED LECTURERS: M. Dauchet, D. Kozen, H. Simonis, G. Smolka, and W. Snyder.
PROGRAM COMMITTEE: A. Aiba, A. Colmerauer, M. Dincbas, H. Ganzinger, S. Haridi, V. Hentenryck, J. Jaffar, J.-P. Jouannaud (chair), C. Kirchner, M. Rodriguez, K. Schulz, and M. Wallace.
INFORMATION: e-mail: Helene.Kirchner@loria.fr.

7–9. **IEEE European Workshop on Computer-Intensive Methods in Control and Signal Processing: Can We Beat the Curse of Dimensionality?**, Prague, Czech Republic. (Jan. 1994, p. 57)

7–9. **IMA Tutorial on Computational Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 144)

11–17. **Homotopietheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

12–16. **Geometrie Algebrique et Analyse Reelle**, CIRM, Marseille, France. (Feb. 1994, p. 144)

*13–17. **II International Symposium on Hamiltonian Systems and Celestial Mechanics**, Cocoyoc, Mexico.

CONFERENCE TOPICS: Periodic orbits, integrability, heteroclinic and homoclinic orbits, invariant submanifolds, ergodicity and global flow of Hamiltonian vector fields.
INVITED SPEAKERS: H. Cendra, H. Cabral, S. Ferraz-Mello, J. Koiller, K. Meyer, W. Oliva, T. Raitu, C. Robinson, D. Rod, D. Saari, D. Schmidt, C. Simo, and J. Xia.
CALL FOR PAPERS: The deadline for abstracts of contributed papers is July 1, 1994.
INFORMATION: E.A. Lacomba, Math. Dept., Universidad Autonoma Metropolitana Iztapalapa, apdo. postal 55-534, 09340 Mexico, D.F., Mexico; e-mail: lace@xanum.uam.mx and J. Llibre (academic organizers). To attend the symposium, contact P. Seligman, HAMSYS2, CIFMA, A.C., apdo. postal 139B, Cuernavaca, Morelos, Mexico; tel and fax: (527) 31-73-388; e-mail: cifma@ce.ifisicam.unam.mx.

14–16. **Fourth International Conference on Algebraic and Logic Programming, Sixth International Symposium on Programming Language Implementation and Logic Pro-**

gramming (ALP '94, PLILP '94), Madrid, Spain. (Feb. 1994, p. 144)

* 14–18. **Sixteenth Linz Seminar on Fuzzy Set Theory, Topology, and Related Topics**, Linz, Austria.

CALL FOR PAPERS: Extended abstracts are to be submitted by June 20, 1994.
INFORMATION: W. Kotze, Dept. of Math., Rhodes Univ., Grahamstown 6140, South Africa; e-mail: mawk@hippo.ru.ac.za; or E.P. Klement, Institut fur Mathematik, Johannes Kepler Universitat, A-4040 Linz, Austria.

15–19. **Fifteenth International Symposium on Mathematical Programming**, University of Michigan, Ann Arbor, MI. (Apr. 1993, p. 416)

18–20. **Teaching of Mathematics for Industry**, Prague. (Jul./Aug. 1993, p. 715)

18–24. **Risk Theory**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

18–24. **DMV-Jahrestagung 1994 (Annual Meeting of the German Mathematical Society)**, Duisburg, Federal Republic of Germany. (Nov. 1993, p. 1258)

19–23. **IMA Workshop on Computational Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 144)

19–23. **3ème Atelier International de Théorie des Ensembles**, CIRM, Marseille, France. (Apr. 1993, p. 416)

21–22. **International Symposium on Object-Oriented Methodologies and Systems**, Palermo, Italy. (Nov. 1993, p. 1258)

21–23. **Meeting on Matrix Analysis and Its Applications**, Vitoria-Gasteiz, Spain. (Oct. 1993, p. 1088)

23–26. **EUROPROJ 94, Barcelona Annual Meeting**, Sant Feliu de Guixols, Spain. (Apr. 1994, p. 382)

25–October 1. **Mathematical Methods in Tomography**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

26–29. **Second International Conference on Theorem Provers in Circuit Design: Theory, Practice, and Experience**, Bad Herrenalb (Blackforest), Germany. (Feb. 1994, p. 144)

26–30. **Annual Conference of the European Association for Computer Science Logic (CSL '94)**, Kazimierz, Poland. (Feb. 1994, p. 144)

26–October 1. **4th International Conference on Evolution Equations and Semigroups**, Scuola Normale Superiore, Pisa, Italy. (Apr. 1994, p. 382)

26–October 1. **First International Workshop on Functional Analysis**, Trier University, near Luxembourg, Germany. (Oct. 1993, p. 1088)

26–30. **Journees de Probabilites**, Marseille, France. (Jan. 1994, p. 58)

* 28–30. **Thirty-second Annual Allerton Conference on Communication, Control, and Computing**, University of Illinois, Urbana-Champaign.

CALL FOR PAPERS: Papers presenting original research are solicted as *regular* papers (suitable for presentation in twenty minutes) and *short* papers (suitable for presentation in ten minutes). Invited sessions are also being organized.
INFORMATION: Conference co-chairmen are W.K. Jenkins and D.V. Sarwate, 32nd Annual Allerton Conference, Univ. of Illinois at Urbana-Champaign, Coordinated Science La., 1308 West Main St., Urbana, IL 61801-2307.

28–30. **Third International Conference on Parallel and Distributed Information Systems**, Austin, Texas. (Jan. 1994, p. 58)

30–October 1. **22nd Annual Mathematics and Statistics Conference on Classical Analysis and General Topology in the Undergraduate Curriculum**, Miami University, Oxford, Ohio. (Apr. 1994, p. 383)

October 1994

* 1–2. **10th Anniversary Symposium**, Ottawa-Carleton Institute of Mathematics and Statistics, Ottawa, Canada.

SPEAKERS: D. Burkholder (Urbana), I.M. Gelfand (Rutgers), R.H. Bott (Harvard), S. Popa (Berkeley), B. Kostant (MIT), and R.P. Stanley (MIT).
INFORMATION: V. Dlab, e-mail: vdlab@math.carleton.ca; or E. Neher, e-mail: neher@acadvm1.uottawa.ca.

* 2–6. **International Conference/Workshop on Applications of Operator Theory**, Winnipeg, Manitoba, Canada.

ORGANIZER: Institute of Industrial Mathematical Sciences (IIMS), University of Manitoba, Canada.
PROGRAM: The purpose of the meeting is to provide an opportunity for the presentation of recent developments in pure and applied research involving the use and development of operator theory. This conference will provide a forum in which mathematicians, engineers, theoretical physicists, and other scientists can exchange ideas and experience. Six topics will be emphasized: (1) Optimal and robust control, (2) Hankel operators and balanced realizations, (3) Interpolation of rational matrix functions, (4) Infinite matrices and projection methods, (5) Schrodinger operators, and (6) Indefinite inner product space and their applications.
CALL FOR PAPERS: Titles and abstracts of invited and contributed papers should be received in Winnipeg by July 31, 1994.
INFORMATION: All enquiries regarding the meeting, including those on contributed papers and support, should be addressed to P.N. Shivakumar, Director, Institute of Industrial Mathematical Sciences, 420 Machray Hall, Univ. of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada; tel: 204-474-6724; fax: 204-275-0019; e-mail: insmath@ccm.umanitoba.ca. As a prelude to the above conference, there will be a program of mini-courses at The Fields Institute of Canada. For application to mini-courses contact Course Registration, The Fields Institute, 185 Columbia St. West, Waterloo, Ontario N2S 5Z5, Canada; e-mail: course@fields.uwaterloo.ca.

2–8. **Randelementmethoden: Anwendungen und Fehleranalysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

3–7. **Groupes Finis**, CIRM, Marseille, France. (Feb. 1994, p. 145)

* 6–9. **Combinatorial Methods for DNA Mapping and Sequencing (DIMACS Workshop)**, Rutgers University, Piscataway, NJ.

PROGRAM: The focus of the workshop will be on the computational problems involved in mapping and sequencing DNA. The scope encompasses the mathematical problems motivated by DNA mapping and sequencing with a strong emphasis on applications of combinatorial methods in molecular biology. The goal is to create a dialogue between biologists and computer scientists.
ORGANIZERS: C. Cantor (Boston Univ.), P. Gillevet (NIH), R. Karp (Univ. of Calif., Berkeley), M. Olson (Univ. of Washington), G. Myers (Univ. of Arizona), P. Pevsner (Penn State), and M. Yannakakis (Bell Labs).
CALL FOR CONTRIBUTED PRESENTATIONS: The workshop will include invited and contributed presentations in the form of papers, poster presentations, and software demonstrations having to do with all areas of DNA mapping and sequencing. Requests for any of the above should include a one-page hard-copy abstract plus any other supporting data, and should be received by July 1, 1994. Submit to P. Pevsner, DNA Mapping and Sequencing Workshop, Dept. of Computer Sci. and Eng., The Pennsylvania State Univ., University Park, PA 16802; e-mail: pevsner@cse.psu.edu. Contributions of open problems are invited for an Open Problems Session. Submit information on the origin/context of the open problem in advance of the workshop dates to G. Myers, Computer Science Dept., Univ. of Arizona, Tuscon, AZ 85721; e-mail: gene@cs.arizona.edu.
INFORMATION: P. Toci, tel: 908-932-5930, e-mail: toci@dimacs.rutgers.edu.

*7–8. **The Twenty-third Annual Midwestern Differential Equations Conference**, University of Oklahoma, Norman, OK.

PROGRAM: The conference will include three one-hour talks; special sessions on nonlinear partial differential equations, inverse problems, mathematical biology, and distributed parameter systems; and sessions for contributed talks.
INVITED SPEAKERS: The plenary lectures will be given by L. Caffarelli (Institute for Advanced Study), S. Lenhart (Univ. of Tennessee), and P. Waltman (Emory Univ.).
CALL FOR PAPERS: Contributed papers on any aspect of the theory or application of differential equations are welcome.
INFORMATION: W. Kelley, e-mail MWDEC@NSFUVAX.MATH.UOKNOR.EDU.

9–15. **Arbeitsgemeinschaft mit Aktuellem Thema (Wird in den Mitteilungen der DMV Heft 3/1994 Bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

10–14. **Journées d'Etude en Statistique**, CIRM, Marseille, France. (Feb. 1994, p. 145)

10–28. **School/Workshop on Variational and Local Methods in the Study of Hamiltonian Systems**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 715)

11–13. **IMA Tutorial on Wavelets, Multigrid and Other Fast Algorithms (Multipole, FFT), and Their Use in Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 145)

12–18. **CARI '94: Second African Conference on Research in Computer Science**, Ouagadougou (Burkina-Faso). (Nov. 1993, p. 1259)

*14–15. **1994 Sixteenth Midwest Probability Colloquium**, Northwestern University, Evanston, IL.

SPEAKERS: D. Ruelle (IHES), P. Baxendale (USC), and C. Mueller (Rochester).
INFORMATION: M. Pinsky, Math. Dept., Northwestern Univ., Evanston, IL 60208-2730; e-mail: pinsky@math.nwu.edu.

16–18. **Women in Probability**, Cornell University, Ithaca, NY. (Apr. 1994, p. 383)

16–22. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

*17–18. **1994 Symposium on Volume Visualization**, Sheraton Premiere at Tysons Corner, VA (Washington, DC area).

PROGRAM: This meeting will provide the opportunity for demonstrations of new developments in this evolving area. Scientists from all disciplines involved in the visual presentation and interpretation of volumetric data are invited to both submit and attend this symposium.
SYMPOSIUM CO-CHAIRS: R. Yagel, Dept. of Computer Science, The Ohio State Univ., Columbus, OH 43210; tel: 614-292-0060; fax: 614-292-2911; e-mail: yagel@cis.ohio-state.edu; and H. Rushmeier, Rm. B-146, Bldg. 225, NIST, Gaithersburg, MD 20899; tel: 301-975-3918; fax: 301-963-9137; e-mail: holly@cam.nist.gov.
PROGRAM CO-CHAIRS: A. Kaufman, Computer Sci. Dept., SUNY, Stony Brook, NY 11794-4400; tel: 516-632-8441/8428; fax: 516-632-8334; e-mail: ari@cs.sunysb.edu; and W. Krueger, Dept. of Scientific Visualization, GMD-HLRZ, P.O. Box 1316, Schloss Birlinghoven, D-5205 Sankt Augustin 1, Germany; tel: +49 (2241) 14-2367; fax: +49 (2241) 14-2040; e-mail: krueger@viswiz.gmd.de.

*17–21. **Visualization '94 Conference**, Sheraton Premiere at Tysons Corner, VA (Washington, DC area).

PROGRAM: Scientific visualization is an important research and applications frontier shared by a variety of science, medicine, and engineering fields. Visualization work is both interdisciplinary and a field in its own right. This conference focuses on interdisciplinary methods and supports collaboration among the developers and users of visualization methods.
CONFERENCE CO-CHAIRS: N. Gershon, The MITRE Corp.; tel: 703-883-7518, e-mail: gershon@mitre.org; and C. Hunter, Lawrence Livermore Nat'l. Lab.; tel: 510-422-1657; e-mail: chunter@llnl.gov.
PROGRAM CO-CHAIRS: L. Rosenblum, Office of Naval Research European Office; e-mail: lrosenblum@onreur.navy.mil; and B. Ribarsky, Georgia Inst. of Technology; tel: 404-894-6148; e-mail: bill.ribarsky@oit.gatech.edu.

17–21. **IMA Workshop on Wavelets, Multigrid and Other Fast Algorithms (Multipole, FFT), and Their Use in Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 145)

*20–24. **First Slovenian Congress of Mathematics**, Cankarjev dom, Ljubljana, Slovenia.

ORGANIZER: Society of Mathematicians, Physicists and Astronomers of Slovenia, The National Committee for Mathematics.
INFORMATION: Society of Mathematicians, Physicists and Astronomers, Jadranska 19, 61111 Ljubljana, Slovenia; tel: 386 61 265-061; fax: 386 61 271-281; e-mail: conference.math@fnt.uni-lj.si.

*21. **Women in Mathematics and Computer Science**, Kean College of New Jersey, Union, NJ.

PROGRAM: This one-day conference will bring together mathematics and computer science professors and high school teachers concerned with increasing the number of women students in mathematics and computer science. Practitioners from industry and academia will address the problems and explore various intervention techniques. The conference will feature a keynote address by P. Kenschaft of Montclair State College, followed by a panel discussion, lunch, and breakout groups.
INFORMATION: B.J. Arnow (chair), Math. and Computer Science Dept., Kean College of NJ, Union, NJ 07083; tel: 908-527-2104; e-mail: barnow@turbo.kean.edu.

17–21. **Algèbre Différentielle**, CIRM, Marseille, France. (Feb. 1994, p. 145)

21–22. **Fourteenth Annual Meeting of the Southeastern-Atlantic Regional Conference on Differential Equations**, University of Tennessee, Knoxville, Tennessee. (Apr. 1994, p. 383)

23–29. **Wahrscheinlichkeitsmaße auf Gruppen und Verwandten Strukturen**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

24–November 11. **Fourth Autumn Course on Mathematical Ecology**, Trieste, Italy. (Jan. 1994, p. 58)

25–27. **Thirteenth Symposium on Reliable Distributed Systems**, Near Irvine, California. (Apr. 1994, p. 383)

26–29. **Sixth IEEE Symposium on Parallel and Distributed Processing**, Dallas, Texas. (Mar. 1994, p. 251)

28–29. **1994 Mathematical Sciences Department Chairs Colloquium**, Arlington, Virginia. (Apr. 1994, p. 383)

28–29. **Central Section**, Oklahoma State University, Stillwater, Oklahoma.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

*28–30. **Hybrid Systems and Autonomous Control**, Cornell University, Ithaca, NY.

PROGRAM: The program committee will form a core of lectures for the workshop. Consisting of a cross-section of invited research papers, there will be both plenary lectures and evening poster sessions.
INVITED SPEAKERS: A. Nerode, P. Antsaklis, A. Pnueli, S. Sastry, P. Varaiya, W. Kohn, J. James, and others to be announced.
INFORMATION: V. Kaine, Mathematical Sciences Institute, 409 College Ave., Ithaca, NY 14850; tel: 607-255-8005; e-mail: vdk1@cornell.edu.

30–November 5. **Finite Volume Methods**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

31–November 4. **Orthogonality, Moment Problems, and Continued Fractions: An International Conference in Honor of T.J. Stieltjes, Jr. (1856–1894)**, Delft, Holland.

(Dec. 1993, p. 1453)

31–November 4. **International Conference of the Chilean Computer Science Society**, Concepcion, Chile. (Apr. 1994, p. 383)

November 1994

2–4. **Mathématique Informatique**, CIRM, Marseille, France. (Feb. 1994, p. 145)

*4–5. **Ninth Annual Pi Mu Epsilon Regional Undergraduate Mathematics Conference**, St. Norbert College, De Pere, WI.

INVITED SPEAKER: R.S. Smith, Miami Univ.

INFORMATION: R. Poss, St. Norbert College, De Pere, WI 54115; tel: 414-337-3198; fax: 414-337-4098; e-mail: `possrl@sncac.snc.edu`.

*7–9. **ISCIS IX (International Symposium on Computer and Information Sciences - 9)**, Antalya, Turkey.

ORGANIZERS: Bogazici Univ. (Istanbul), in corporation with IEEE Computer Society (Turkey chapter) and IEEE (Turkey section).

CONFERENCE CHAIR: S. Kuru (Bogazici Univ.).

PROGRAM CHAIRS: M. U. Caglayan (Bogazici Univ.) and E. Gelenbe (Duke Univ.).

PROGRAM: The special theme of the conference is "High Performance Computing", highlighting contributions from leading researchers who are working on software and hardware systems to achieve high performance in different fields of computer and information sciences.

PAPER SUBMISSION: Submit four copies (one camera-ready and three copies) of the full paper (limited to eight pages and in English) by May 31, 1994 to: ISCIS IX, Dept. of Computer Engineering, Bogazici Univ., Bebek 80815, Istanbul, Turkey; tel: +90 (212) 263 1540, ext. 1323; fax: +90 (212) 265 8488. Information on submission format can also be obtained from the above address.

INVITED SESSIONS: The symposium welcomes proposals for invited sessions, especially on high-performance computing issues. Proposals should be sent by May 31, 1994, to the above address. The organizer for each invited session should submit a title, brief description of the relevance of the session to the conference, and a maximum of four invited full papers for review.

7–18. **2nd Workshop on Three-dimensional Modelling of Seismic Waves Generation, Propagation, and Their Inversion**, Trieste, Italy. (Feb. 1994, p. 145)

9–10. **IMA Tutorial on Waves in Random and Other Complex Media**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 145)

11–13. **Southeastern Section**, University of Richmond, Richmond, VA.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

13–17. **1994 International Symposium on Logic Programming**, MSI, Ithaca, NY. (Jul./Aug. 1993 p. 715)

13–19. **Komplexitätstheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

14–18. **International Conference on Mathematical Ecology**, Trieste, Italy. (Feb. 1994, p. 145)

14–18. **IMA Workshop on Waves in Random and Other Complex Media**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 145)

14–18. **Nouvelles Tendances et Approximation**, CIRM, Marseille, France. (Feb. 1994, p. 145)

14–18. **Supercomputing '94, the Seventh Annual High-performance Computing and Communication Conference**, Convention Center, Washington, DC. (Apr. 1994, p. 384)

*16–18. **Envirosoft 94 (Development and Application of Computer Techniques to Environmental Studies)**, San Francisco, CA.

OBJECTIVES: Envirosoft 94 encourages the submission of papers on recent advances in environmental software, computer simulation, organization of theories into structural algorithms, mathematical models, software optimization, scope and application of computer programs.

INFORMATION: S. Owen, Conference Secretariat, Envirosoft 94, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO4 2AA, UK; tel: +44 (0) 703 293223; fax: +44 (0) 703 292853; e-mail: `CMI@uk.ac.rl.ib`.

20–26. **Mathematical Aspects of Computational Fluid Dynamics**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

*21–27. **Thanksgiving Workshop on Controlled Topology, Geometry and Algebra**, IMADA, Odense University, Odense, Denmark.

PARTICIPATION: Participation is mainly by invitation. There will, however, be room for a few extra participants.

CALL FOR PAPERS: Deadline for submission of papers for the Proceedings is January 1, 1995.

CONFIRMED INVITED ATTENDEES: D.R. Anderson, O. Attie, S. Ferry, I. Hambleton, T. Kozniewski, I. Madsen, E.K. Pedersen, S. Prassidis, A. Ranicki, W. Vogell, and M. Weiss.

ORGANIZER: H.J. Munkholm.

SPONSORS: The workshop is sponsored in part by grants from SNF, Denmark, and the European Union.

INFORMATION: H.J. Munkholm, IMADA, Odense Universitet, DK 5230 Odense M, Denmark; tel: +45 66 15 86 96 (tone) 2309 or 2387; fax: +45 65 93 26 91; e-mail: `hjm@imada.ou.dk`.

*27–December 3. **The Norbert Wiener Centenary Congress**, Michigan State University, East Lansing, MI (Preliminary Announcement)

SPONSORS: World Organization of Systems and Cybernetics and Dept. of Statistics and Probability, Michigan State University.

THEME: A mathematician on par with the greatest in the century, Norbert Wiener (born November 26, 1894) was a universal thinker of colossal proportions. His early training in mathematical logic and fascination for electricity were soon intertwined and led to his conception of the subject of cybernetics and to a penetrating insight into automatization in all its aspects. The aim of this congress is to reveal the depth and strong coherence of thought that runs through Wiener's entire legacy and to exhibit its continuation in ongoing research. The program, organized in eight clusters, is designed to accomplish this goal.

PROGRAM: I.) WIENER'S CONCEPT OF THE STOCHASTIC UNIVERSE. The Wiener-Kolmogorov conception of the stochastic organization of nature (S. Molchanov), Shannon-Wiener information and the analysis of complexity (J. Rissanen), The mathematical ramifications of Wiener's program in statistical physics (L. Gross). II.) POTENTIAL AND CAPACITY BEFORE AND AFTER WIENER (D. Adams). III.) GENERALIZED HARMONIC ANALYSIS AND ITS RAMIFICATIONS. Wiener and the uncertainty principle of harmonic analysis (D.H. Phong), Generalized harmonic analysis and wavelets (J. Benedetto), The Wiener-Hopf integral equation (I.C. Gohberg). IV.) QUANTUM MECHANICAL RAMIFICATIONS OF WIENER'S IDEAS. Quantum field theory and functional integration (I.E. Segal), Optical coherence before and after Wiener (J.R. Klauder), The Feynman integral (S. Albeverio), Wiener and the hidden parameter problem (E. Carlen). V.) LEIBNIZ, HALDANE, AND WIENER ON MIND. The role of Leibniz in Wiener's cybernetics (E. Vailati), Quantum mechanical coherence, resonance and mind (H. Stapp), Evidence from brain research regarding conscious processes (K. Pribram). VI.) NONLINEAR STOCHASTIC ANALYSIS. Some nonlinear problems in stochastic analysis (D.L. Burkholder), Nonlinear prediction and filtering (G. Kallianpur), Stochastic differ-

ential equations (S. Watanabe), Stochastic control (S.K. Mitter). VII.) PROSTHESIS, ONTOGENETIC, AND PHYLOGENETIC. Muscular and sensory prosthesis in the aftermath of Wiener (R.W. Mann), Wiener's thought on the computer as an aid in visualizing higher-dimensional forms and the problems of its implementation in the design of the robot arm (F. Potra). VIII.) WIENER AND THE POLITICAL ECONOMY. The relationship of cybernetics and automation to the economy (L. Klein), The role of information in economic processes (L. Hurwicz). The program will also include sessions devoted to 20-minute papers.

ORGANIZING COMMITTEE: J. Benedetto (Univ. of Maryland), T. Kailath (Stanford Univ.), G. Kallianpur (Univ. of N. Carolina), V. Mandrekar (Michigan State Univ. and sponsor), P.R. Masani (Univ. of Pittsburgh and WOSC representative), S. Mitter (MIT), and I.E. Segal (MIT).

CALL FOR PAPERS: Persons interested in submitting papers or attending the congress should write to V. Mandrekar, Dept. of Statistics and Probability, Michigan State Univ., East Lansing, MI 48824; tel: 517-353-7172; fax: 517-336-1405; e-mail: `atmah@mandrekar.stt.mus.edu`. Women and minorities are encouraged to apply.

27–December 3. **Mathematical Models for Infectious Diseases**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

December 1994

4–10. **Applied Probability**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

5–9. **20th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**, Auckland, New Zealand. (Apr. 1994, p. 384)

12–14. **SIAM Conference on Inverse Problems**, Fish Camp, CA. (Dec. 1993, p. 1453)

* 12–16. **International Conference on Set-theoretic Topology and its Applications**, Ehime University, Matsuyama, Japan.

PROGRAM: The conference will be held as a joint meeting of Japanese set-theorists and topologists.

CONFERENCE TOPICS: Set theory, general topology, geometric topology, continuum theory and dynamical systems, topological groups, and connections of topology with other areas of mathematics.

INVITED SPEAKERS: A. Arhangel′skiĭ (Russia), D. Burke (USA), P. Collins (England), W. Comfort (USA), D. Dikranjan (Italy), S. Dolecki (France), A. Dow (Canada), A. Dranishnikov (Russia), J. Dydak (USA), K. Eda (Japan), V. Fedorčuk (Russia), M. Foreman (USA), G. Gruenhage (USA), K. Hiraide (Japan), M. Hušek (Czech Rep.), H. Kato (Japan), J. Kulesza (USA), H-P. Künzi (Switzerland), J. Keesling (USA), W. Lewis (USA), J. van Mill (Netherlands), S. Morris (Australia), J.-iti Nagata (Japan), H. Ohta (Japan), O. Okunev (Russia), J. Pelant (Czech Republic), D. Repovš (Slovenia), E. Reznichenko (Russia), M. Shishikura (Japan), F. Tall (Canada), S. Todorčević (Serbia), and S. Watson (Canada).

CALL FOR PAPERS: Fifteen-minute contributed talks are solicited.

INFORMATION: Topology Conference, Dept. of Math., Faculty of Science, Ehime Univ., Matsuyama 790, Japan; fax: (+81 899) 23 2545; e-mail: `hiraide@dpcsipc.dpc.ehime-u.ac.jp`.

* 12–17. **International Conference on Operator Theory for Complex and Hypercomplex Analysis**, Mexico City, Mexico.

PROGRAM: Integral representations for different classes of functions in analysis motivate the introduction and the study of a series of important operators: singular integral, Toeplitz, Bergman, convolution operators on Lie groups, some classes of pseudodifferential operators, etc. Investigation of these operators develops and enriches the "pure" operator theory and has a stimulating influence on important areas of analysis. The aim of the conference is both to study the role of general operator theory in these areas of analysis and to investigate different classes of operators appearing in them.

CALL FOR PAPERS: Abstracts should be submitted by September 15, 1994. Late abstracts will be considered if possible.

LOCAL ORGANIZING COMMITTEE: E. Ramirez de Arellano (chair), N.L. Vasilevski, M.V. Shapiro, and V.V. Kisil (secretary).

INFORMATION: E. Ramirez de Arellano, Dept. of Math., Centro de Investigacion y de Estudios Avanzados del IPN, P.O. Box 14740, Mexico City, Mexico CP 07000; tel: 525-754-4466; fax: 525-752-6412; e-mail: `confmath@mvaxl.red.cinvestav.mx`.

12–17. **Pacific Rim Geometry Conference**, National University of Singapore, Republic of Singapore. (Feb. 1994, p. 146)

16–19. **International Symposium on Methods and Applications of Analysis**, Hong Kong. (Mar. 1994, p. 251)

18–23. **Asymptotik Hochdimensionaler Statistischer Modelle**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

* 27–31. **21st Holiday Mathematics Symposium on Gröbner Bases and Convex Polytopes**, New Mexico State University.

GENERAL DESCRIPTION: The lectures give an introduction to Gröbner bases and their relations to toric varieties and convex polytopes, with an emphasis on recent applications in the domains of integer programming and computational statistics. They are at a level suitable for graduate students wishing to learn this subject. It is hoped that partial financial support can be provided to a portion of participants. Graduate students, women, and minorities are especially encouraged to apply.

MAIN SPEAKER: B. Sturmfels, Cornell Univ., will deliver ten lectures. There will also be a contributed paper session.

INFORMATION: R. Laubenbacher, Dept. of Mathematical Sciences, New Mexico State Univ., Las Cruces, NM 88003; tel: 505-646-3901; e-mail: `holiday@math.nmsu.edu`.

Second International Conference on Numerical Methods for Volterra and Delay Equations (A conference to celebrate the 100th anniversary of Volterra's birth.), Italy. (Mar. 1992, p. 251)

January 1995

* January–June. **Financial Mathematics**, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK.

ORGANIZING COMMITTEE: M.H.A. Davis, S.D. Hodges, I. Karatzas, and L.C.G. Rogers.

PROGRAM: The six-month research program will comprise visits by many leading academics from the various subjects nowadays involved in the theory and practice of finance and visits by interested practitioners. It is intended to begin in January with an introductory meeting of one week's duration, the first half of which will present to a general audience some of the problems and techniques which are tackled already in financial theory and application, and the second half of which will seek to define a number of areas of outstanding open interest and review progress so far in those areas. Later, during one week around Easter, S. Howison will lead a practitioners' workshop, where experienced practitioners will be invited to discuss very concrete problems with the academic visitors at the Newton Institute, who will, for at least that week, include a number of well-known applied mathematicians with expertise in solving real-world problems. Toward the end of the program, the intention is to hold a major international meeting, of about ten days' duration, with a more conventional format.

INFORMATION: L.C.G. Rogers, School of Mathematical Sciences, Bath Univ., Claverton Down, Bath BA2 7AY, UK; tel: (uk) 225 826224; fax: (uk) 225 826492; e-mail: `lcgr@maths.bath.ac.uk`.

4–7. **Joint Mathematics Meetings**, San Francisco, CA (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

*8–12. **8th Texas International Symposium on Approximation Theory**, College Station, TX.

TOPIC: General approximation theory.

INVITED SPEAKERS: E.W. Cheney, W.A. Dahmen, I. Daubechies, R.-Q. Jia, D.S. Lubinsky, C.A. Micchelli, G.J.G. Pisier, R.A. Schaback, and G. Wahba. The winner of the newly established Popov Prize will be announced and will give a special lecture.

CALL FOR PAPERS: Deadline for abstracts of contributed twenty-minute papers is October 1, 1994.

INFORMATION: C.K. Chui, Center for Approximation Theory, Texas A&M Univ., College Station, TX 77843-3368; e-mail `cat@math.tamu.edu`.

*15–17. **Random Partial Differential Equations, MSI**, Ithaca, NY.

PROGRAM: The very general subject will be partial differential equations in which something is random. Different methods of introducing the randomness lead to quite different problems.

INVITED SPEAKERS: R. Carmona (U.C. Irvine), D. Dawson (Carleton Univ.), J. Glimm (Stony Brook), A. Majda (Princeton), C. Mueller (Rochester), G. Papanicoloau (Stanford), E. Perkins (U. of Br. Columbia), D. Sharp (Los Alamos), B. White (Exxon), H.T. Yau (Courant), and Q. Zhang (Stony Brook).

INFORMATION: R. Durrett, MSI, 409 College Ave., Ithaca, NY 14850; tel: 607-255-8282; e-mail: `rtd1@cornell.edu`.

16–19. **First Asian Computational Fluid Dynamics Conference**, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong. (Jan. 1994, p. 58)

17–20. **IMA Tutorial 1 on Inverse Problems in Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 146)

*23–27. **3rd International Symposium on the Development of Mathematics**, Havana, Cuba.

INFORMATION: ICIMAF-ACC, Calle 15 No. 551, Vedado, La Habana 10400, Cuba; e-mail: `icimk@redacc.cu`.

30–February 3. **IMA Tutorial 2 on Inverse Problems in Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Feb. 1994, p. 146)

February 1995

5–8. **The Joint Meeting of the Third Caribbean Congress on Fluid Dynamics and the Third Latin-American Symposium on Fluid Mechanics**, The University of Simon Bolivar, Caracas, Venezuela. (Apr. 1994, p. 384)

*19–25. **Applications of Interval Computations (First International Workshop)**, El Paso, TX.

TOPICS: All areas of applications of interval mathematics and interval computations, especially applications to manufacturing and (broadly understood) quality control. Solutions, methods, open problems, and even raw ideas are welcome.

DEADLINE FOR ABSTRACTS: Send an abstract of four pages or less by September 1, 1994, to V. Kreinovich, Dept. of Computer Science, Univ. of Texas at El Paso, El Paso, TX 79968; tel: 915-747-6951; fax: 915-747-5030; e-mail: `vladik@cs.ep.utexas.edu`.

March 1995

4–5. **Eastern Section**, Hartford, Connecticut.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

6–17. **IMA Workshop on Inverse Problems in Wave Propagation**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1994, p. 384)

17–18. **Southeastern Section**, Orlando, FL.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

*19–22. **Colloquium Carolus Magnus on Arithmetic and Geometry (Celebrating 1200 Years of Science in Central Europe)**, Aachen, Germany.

PROGRAM: There will be invited lectures and sections for contributed papers. Papers on both modern and historical topics are encouraged. The tentative scope of the meeting will include such topics as number theory, combinatorics, optimization and complexity, discrete geometry, differential geometry, algebraic geometry, and history of mathematics.

PRELIMINARY SCIENTIFIC BOARD: P.L. Butzer (chair), W. Benz, I. Ekeland, D. Foata, M. Groetschel, H.Th. Jongen, H.W. Lenstra, W. Oberschelp, and S. Smale.

LOCAL ORGANIZING COMMITTEE: W. Oberschelp (chair), and members of the depts. of mathematics of the ALMA Universities (Aachen, Liège, and Maastricht).

INFORMATION: Registration forms can be ordered by phone, fax, or mail from W. Oberschelp, RWTH Aachen, Dept. of Math.,52056 Aachen, Germany; tel:++49-241-80-21050; fax: ++49-241-8888-215; e-mail: `carolus@rwth-aachen.de`. Deadline for registration is Oct. 31, 1994. Deadline for abstracts (for 30-minute presentations) is November 30, 1994.

*26–29. **IMS Eastern Regional Meeting and Biometric Society/ENAR Spring Meeting**, Birmingham, AL.

INFORMATION: J.M. Hardin, Dept. of Biostatistics and Biomathematics, Univ. of Alabama, 212 Tidwell Hall, Birmingham, AL 35294.

24–25. **Central Section**, DePaul University, Chicago, IL.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

April 1995

*1–4. **International Conference on Survey Measurement and Process Quality**, Bristol, England.

INFORMATION: L. Lyberg, R&D Dept., Statistics Sweden, 115 81 Stockholm, Sweden.

*2–9. **7th International Conference on Geometry**, Nahsholim, Israel.

TOPICS: Foundations of geometry, geometric algebra, discrete and combinatorial geometry, and convexity. Special section: geometry and school.

INFORMATION: R. Artzy, Dept. of Math., Univ. of Haifa, 31905 Haifa, Israel; e-mail: `RSMA787@HAIFAUVM`; or J. Zaks (same address), e-mail: `J.Zaks@HAIFAUVM`.

4–6. **IMA Tutorial on Singularities and Oscillations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

*10–12. **International Conference on Typed Lambda Calculi and Applications (TLCA)**, Edinburgh, Scotland.

TOPICS: Proof theory of type systems, logic and type systems, typed lambda calculi as models of (higher order) computation, semantics of type systems, proof verification via type systems, type systems of programming languages, and typed term rewriting systems.

PROGRAM COMMITTEE: H. Barendregt, M. Dezani (chair), J-Y. Girard, R. Hindley, F. Honsell, J.W. Klop, G. Longo, A. Meyer, G. Plotkin, P. Scott, J. Smith, and J. Tiuryn.

SUBMISSIONS: Electronic submission (PostScript only) is preferred; hard copy (six

copies required) will also be accepted. Send to address below. Papers should not exceed fifteen standard pages and should be accompanied by a one-page abstract. The deadline for submissions is September 8, 1994.

INFORMATION: TLCA Secretariat, M. Dezani, Universita di Torino, Dipartimento di Informatica, Corso Svizzera, 185, 10149 Torino, Italy; tel: 39-11-7429232; fax: 39-11-751603; e-mail: dezani@di.unito.it.

10–14. **IMA Workshop on Singularities and Oscillations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

Spring 1995. **Workshop on Groups and Three-Manifolds**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 59)

Spring-Summer 1995. **Workshop on Gauge Theory and Applications to Low-dimensional Topology**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 59)

Spring-Summer 1995. **Workshop on Symplectic Geometry and Topology**, Centre de Recherches Mathématiques, Université de Montréal. (Jan. 1994, p. 59)

*23–25. **Conference on Applied Statistics in Agriculture**, Manhattan, KS.

INFORMATION: J.R. Schwenke or G.A. Milliken, Kansas State Univ., Dept. of Statistics, Dickens Hall, Manhattan, KS 66506-0802.

23–26. **KdV '95**, Amsterdam, The Netherlands. (Dec. 1993, p. 1453)

May 1995

14–20. **Mathematical Models in Phase Transitions**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

16–18. **IMA Tutorial on Quasiclassical Methods**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

*16–20. **Seventh International Conference on Random Structures and Algorithms**, Emory University, Atlanta, GA.

TOPIC: This is the seventh in a series of meetings on random graphs and probabilistic algorithms held each two years in Poznan, Poland. In this instance, the meeting will be held in Atlanta, GA, jointly organized by the Dept. of Discrete Math., Adam Mickiewicz Univ. and the Dept. of Math. and Computer Science, Emory University. The aim of the meeting is to present recent research and to identify and explore directions for further developments in random discrete structures, randomized algorithms, and broad areas of applications of probabilistic methods in discrete mathematics and computer science.

PROGRAM: Hour addresses by invited speakers and sessions of twenty-minute contributed talks.

INVITED SPEAKERS (PRELIMINARY LIST): D. Aldous (UC Berkeley), L. Babai (Univ. Chicago, Eotvos Univ.), B. Bollobas (Univ. Cambridge), Z. Furedi (Univ. Illinois), R. Graham (AT&T Bell Labs), P. Erdhos (Hungarian Acad. Sci.), J. Kahn (Rutgers Univ.), L. Lovasz (Yale Univ.), M. Luby (ICSI), P. Raghavan (IBM), A.A. Razborov (Stekov Math. Inst.), E. Szemeredi (Rutgers Univ.), J. Spencer (Courant Inst.), L. Shepp (AT&T Bell Labs.), W.T. Trotter (ASU), and N. Wormald (Univ. Melbourne).

INFORMATION: D. Duffus, Math. and CS Dept., Emory Univ., Atlanta, GA 30322; e-mail: tt rg95@mathcs.emory.edu or Michal Karoński, Discrete Math. Dept., Adam Mickiewicz Univ., Pozńa, Poland; e-mail: rg95@plpuamll.amu.edu.pl.

22–26. **IMA Workshop on Quasiclassical Methods**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Mar. 1994, p. 252)

*24–27. **Second International Conference on Dynamic Systems and Applications**, Atlanta, GA.

TOPICS: General topics of the conference are theoretical and numerical methods in the areas of differential equations, integral equations, discrete analogs of these equations, and applications of these equations to various sciences and engineering.

CALL FOR PAPERS: Authors of contributed papers are requested to submit, before February 15, 1995, an abstract containing the topic of talk, a summary of talk (not exceeding a half-page typed), full address of each author, along with telephone and fax numbers, and e-mail address.

INFORMATION: M. Sambandham, ICDSA, Dept. of Math., Morehouse College, Atlanta, GA 30314; tel: 404-215-2614; fax: 404-458-7932; e-mail: ICDSA@VOYAGER.CAU.AUC.EDU. To receive the second announcement, please send your name and address before December 1, 1994.

*25–June 5. **Summer School and International Conference on Combinatorics**, Hefei, China.

INFORMATION: K. Tung-Hsin, The Hefei Branch Research Centre of Combinatorial Mathematics and Computer Science, Academia Sinica, P.O. Box 1110 Hefei, Anhui 230031, China.

*28–31. **First International Conference on Neural, Parallel & Scientific Computations**, Atlanta, GA.

SPONSORS: The conference is under the auspices of the International Federation for Nonlinear Analysts and the Interdisciplinary Neural Modeling Society.

CALL FOR PAPERS: Authors of contributed and invited papers are requested to submit, before January 15, 1995, an article (not to exceed four pages) on their research presentation. Please type each article (single-spaced) on one side of 8.5× 11″ paper, with a one-inch margin on all sides.

INFORMATION: M. Sambandham, ICNPSC, Dept. of Math., Morehouse College, Atlanta, GA 30314; tel: 404-215-2614; fax: 404-458-7932; e-mail: ICNPSC@VOYAGER.CAU.AUC.EDU. To receive the second announcement, please send the following before December 1, 1994: your name, address, telephone number, fax number, and e-mail address.

June 1995

*Model Oriented Data Analysis, Spetses, Greece.

INFORMATION: C.P. Kitsos, Athens Univ. of Economics and Business, 76 Patission St., GR-104 34 Athens, Greece.

*5–8. **International Conference on Optimization: Techniques and Applications (ICOTA '95)**, Chengdu University of Science and Technology, Chengdu, China.

THEME: Towards optimization techniques and applications for the twenty-first century.

SPONSORS: The Systems Engineering Society of China, Operations Research Society of China, Regional Science Assoc. of China, National Natural Science Found. of China, and Sichuan Assoc. for Science and Technology.

ORGANIZERS: Chengdu Univ. of Science and Technology and National Univ. of Singapore.

STRUCTURE AND SCOPE: The conference will include plenary and parallel sessions for invited and contributed papers as well as tutorials. Topics of the sessions will cover all aspects of optimization techniques and applications.

ABSTRACTS: Individuals interested in presenting papers should submit three typewritten copies of the abstract containing: title of the paper; name(s), affiliation(s), address(es), telephone, fax or telex numbers, and e-mail address; and up to six key words to explain the paper. Deadline for submission: Sept. 1, 1994.

INFORMATION: C. Wang, Dept. of Math., Univ. of Louisville, Louisville, KY 40292; tel: 502-852-6827; fax: 502-499-5844; e-mail: c0wang01@ulkyvx.louisville.edu.

7–8. **IMA Tutorial on Multiparticle Quantum Scattering with Applications to Nuclear, Atomic, and Molecular Physics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1994, p. 385)

12–16. **IMA Workshop on Multiparticle Quantum Scattering with Applications to Nuclear, Atomic, and Molecular Physics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Apr. 1994, p. 385)

INFORMATION: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church St., SE, Minneapolis, MN 55455.

July 1995

* 8–9. **Mathematica in Mathematics Research and Education**, University of Tasmania.

INFORMATION: D. Fearnley-Sander, Dept. of Math., Univ. of Tasmania, Hobart, Tas., 7001.

* 10–14. **7th Biennial Conference of the Computational Mathematics Group at Melbourne (CTAC 95)**, Melbourne, Australia.

INFORMATION: A. Easton, Dept. of Math., Swinburne Univ. of Tech., Hawthorn, 3122; tel: (03) 819 8285; fax: (03) 819 0821; e-mail: `ctac95@swin.edu.au`.

The following new announcements will not be repeated until the criteria in the last paragraph in the box at the beginning of this section are met.

August 1995

6–8. **MATHFEST**, University of Vermont, Burlington, Vermont (including the summer meetings of the AMS, AWM, MAA, and PME).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

* 28–September 1. **A.C. Aiken Centenary Conference, incorporating the 3rd Pacific Statistical Congress and the annual meeting of the New Zealand Statistical Association**, University of Otago.

INFORMATION: A.C. Aitken, Conference Secretary, Dept. of Math. and Statistics, Univ. of Otago, P.O. Box 56, Dunedin, New Zealand; tel: 64-3-479-7774; fax: 64-3-479-8427; e-mail: `casm@maths.otago.ac.nz`.

October 1995

7–8. **Eastern Section**, Northeastern University, Boston, Massachusetts.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

November 1995

3–4. **Central Section**, Kent State University, Kent, Ohio.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

17–18. **Southeastern Section**, University of North Carolina, Greensboro, NC.

INFORMATION: W.S. Drady, AMS P.O. Box 6887, Providence, RI 02940.

January 1996

10–13. **Joint Mathematics Meetings**, Orlando, Florida (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

March 1996

22–23. **Central Section**, University of Iowa, Iowa City, Iowa.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

April 1996

19–21. **Southeastern Section**, Baton Rouge, Louisiana.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

November 1996

1–3. **Central Section**, University of Missouri at Columbia, Columbia, Missouri.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

January 1997

10–13. **Joint Mathematics Meetings**, San Diego, California (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

January 1998

10–13. **Joint Mathematics Meetings**, Baltimore, Maryland (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

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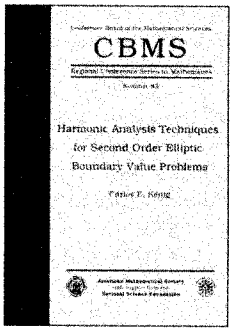

Harmonic Analysis Techniques for Second Order Elliptic Boundary Value Problems

Carlos E. Kenig

Volume 83

(Supported by the National Science Foundation)

In recent years, there has been a great deal of activity in the study of boundary value problems with minimal smoothness assumptions on the coefficients or on the boundary of the domain in question. These problems are of interest both because of their theoretical importance and the implications for applications, and they have turned out to have profound and fascinating connections with many areas of analysis. Techniques from harmonic analysis have proved to be extremely useful in these studies, both as concrete tools in establishing theorems and as models which suggest what kind of result might be true. Kenig describes these developments and connections for the study of classical boundary value problems on Lipschitz domains and for the corresponding problems for second order elliptic equations in divergence form. He also points out many interesting problems in this area which remain open.

Contents

Introduction; Divergence form elliptic equations; Some classes of examples and their perturbation theory; Epilogue: Some further results and open problems; References.

1991 *Mathematics Subject Classification*: 35–02; 42B20
ISBN 0-8218-0309-3, LC 94-14960, ISSN 0160-7642
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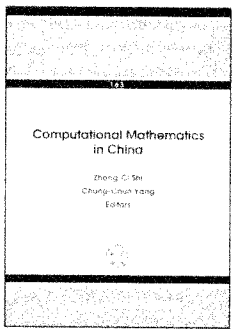

Computational Mathematics in China

Zhong-Ci Shi and Chung-Chun Yang, Editors

Volume 163

This volume describes the most significant contributions made by Chinese mathematicians over the past decades in various areas of computational mathematics. Some of the results are quite important and complement Western developments in the field. The contributors to the volume range from noted senior mathematicians to promising young researchers. The topics include finite element methods, computational fluid mechanics, numerical solutions of differential equations, computational methods in dynamical systems, numerical algebra, approximation, and optimization. Containing a number of survey articles, the book provides an excellent way for Western readers to gain an understanding of the status and trends of computational mathematics in China.

Contents

K. Feng and D. Wang, *Dynamical systems and geometric construction of algorithms;* **B. Guo**, *Generalized stability of discretization and its applications to numerical solutions of nonlinear differential equations;* **H. Han**, *The boundary element method for solving variational inequalities;* **E. Jiang**, *The study of numerical analysis of matrix eigenvalue problem in China;* **Y. Kwok, H. Huang, and R. H. Chan**, *Numerical analysis and scientific computation in Hong Kong;* **Q. Lin**, *Interpolated finite elements and global error recovery;* **Z. Shi and M. Wang**, *Mathematical theory of some non-standard finite element methods;* **J. Sun**, *Some results on the field of spline theory and its applications;* **R. Wang**, *Approximation theory and spline function;* **X. Wang**, *A summary on continuous complexity theory;* **L. Ying**, *Viscosity splitting schemes;* **D. Yu**, *Natural boundary element method and adaptive boundary element method;* **Y. Yuan**, *Trust region algorithms for nonlinear programming.*

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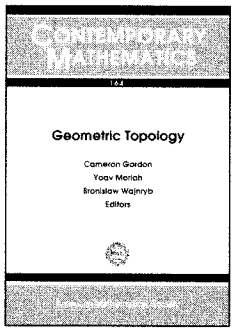

Geometric Topology

Cameron Gordon, Yoav Moriah, and Bronislaw Wajnryb, Editors

Volume 164

Geometric topology has undergone tremendous changes in the past decade. Many of the big questions facing mathematicians in this area have been answered, and new directions and problems have arisen. One of the characteristics of the field is the diversity of tools researchers bring to it. A Workshop on Geometric Topology was held in June 1992 at Technion-Israel Institute of Technology in Haifa, to bring together researchers from different subfields to share knowledge, ideas, and tools. This volume contains the refereed proceedings of the conference.

Contents

A. J. Duncan and J. Howie, *The 3-torus is Kervaire;* **M. Farber and J. Levine**, *A topological interpretation of the Atiyah-Patodi-Singer invariant;* **B. Fine and G. Rosenberger**, *On groups of special NEC type—A Freiheitssatz and related results for a class of multi-relator groups;* **D. Gillman, S. Matveev, and D. Rolfsen**, *Collapsing and reconstruction of manifolds;* **J. Hass**, *Metrics on manifolds with convex or concave boundary;* **K. N. Jones**, *Geometric structures on branched covers over universal links;* **U. Kaiser**, *Link homotopy and skein modules of 3-manifolds;* **U. Koschorke**, *Bordism of link maps and selfintersections;* **A. Leibman and D. Markushevich**, *The monodromy of the Brieskorn bundle;* **G. Masbaum and P. Vogel**, *Verlinde formulae for surfaces with spin structure;* **K. Miyazaki and A. Yasuhara**, *Knots that cannot be obtained from a trivial knot by twisting;* **B. Moishezon**, *The arithmetic of braids and a statement of Chisini;* **K. Morimoto**, *On tunnel number and connected sum of knots and links;* **R. Naimi**, *Essential laminations in 3-manifolds obtained by surgery on 2-bridge knots;* **F. Paulin**, *A dynamical system approach to free actions on $\mathbb{R}$-trees: A survey with complements;* **S. Matveev and M. Polyak**, *On a tangle presentation of the mapping class groups of surfaces;* **M. Scharlemann and A. Thompson**, *Thin position for 3-manifolds;* **K. Taniyama**, *On embeddings of a graph into R^3.*

1991 *Mathematics Subject Classification*: 57M05, 57M07, 57M25, 57M50, 57Q45, 57M60
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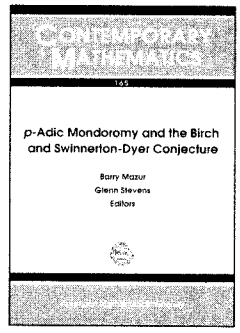

p-Adic Monodromy and the Birch and Swinnerton-Dyer Conjecture

Barry Mazur and Glenn Stevens, Editors

Volume 165

Recent years have witnessed significant breakthroughs in the theory of p-adic Galois representations and p-adic periods of algebraic varieties. This book contains papers presented at the Workshop on p-Adic Monodromy and the Birch and Swinnerton-Dyer Conjecture, held at Boston University in August 1991. The workshop aimed to deepen understanding of the interdependence between p-adic Hodge theory, analogues of the conjecture of Birch and Swinnerton-Dyer, p-adic uniformization theory, p-adic differential equations, and deformations of Galois representations. Much of the workshop was devoted to exploring how the special values of (p-adic and "classical") L-functions and their derivatives are relevant to arithmetic issues, as envisioned in "Birch-Swinnerton-Dyer-type conjectures", "Main Conjectures", and "Beilinson-type conjectures" à la Greenberg and Coates.

Contents

B. Mazur, *On monodromy invariants occurring in global arithmetic, and Fontaine's theory;* **R. F. Coleman**, *A p-adic Shimura isomorphism and p-adic periods of modular forms;* **R. Coleman and J. Teitelbaum**, *Numerical solution of the p-adic hypergeometric equation;* **J. W. Jones**, *Iwasawa L-functions and the mysterious $\mathcal{L}$-invariant;* **K. Rubin**, *p-adic variants of the Birch and Swinnerton-Dyer conjecture for elliptic curves with complex multiplication;* **K. Kitagawa**, *On standard p-adic L-functions of families of elliptic cusp forms;* **K.-S. Tan**, *p-adic pairings;* **J. Silverman**, *Variation of the canonical height in algebraic families;* **E. de Shalit**, *Kronecker's polynomial, supersingular elliptic curves, and p-adic periods of modular curves;* **R. Greenberg**, *Trivial zeros of p-adic L-functions;* **B. W. Jordan**, *Higher weight modular forms and Galois representations;* **R. Greenberg and G. Stevens**, *On the conjecture of Mazur, Tate, and Teitelbaum;* **H. Carayol**, *Formes modulaires et représentations Galoisiennes à valeurs dans un anneau local complet;* **N. Jochnowitz**, *A p-adic conjecture about derivatives of L-series attached to modular forms;* **H. Darmon**, *Euler systems and refined conjectures of Birch Swinnerton-Dyer type;* **C. Klingenberg**, *On p-adic L-functions of Mumford curves.*

1991 *Mathematics Subject Classification*: 11G40; 14F30
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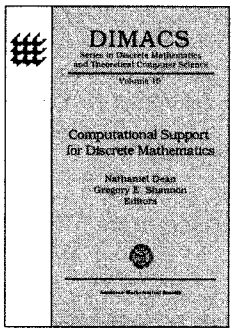
DIMACS: SERIES IN DISCRETE MATHEMATICS AND THEORETICAL COMPUTER SCIENCE



Computational Support for Discrete Mathematics

Nathaniel Dean and Gregory E. Shannon, Editors

Volume 15

With recent technological advances in workstations, graphics, graphical user interfaces, and object oriented programming languages, a significant number of researchers are developing general-purpose software and integrated software systems for domains in discrete mathematics, including graph theory, combinatorics, combinatorial optimization, and sets. This software aims to provide effective computational tools for research, applications prototyping, and teaching. In March 1992, DIMACS sponsored a workshop on Computational Support for Discrete Mathematics in order to facilitate interactions between the researchers, developers, and educators who work in these areas. Containing refereed papers based on talks presented at the workshop, this volume documents current and past research in these areas and should provide impetus for new interactions.

Contents

A. Bhansali and S. S. Skiena, *Analyzing integer sequences;* **M. Stallmann, R. Cleaveland, and P. Hebbar**, *GDR: A visualization tool for graph algorithms;* **G. Havas and E. F. Robertson**, *Application of computational tools for finitely presented groups;* **P. A. Gloor, I. Lee, and A. Velez-Sosa**, *Animated algorithms: Computer science education with algorithm animation;* **J. Abello, S. Sudarsky, T. Veatch, and J. Waller**, *AGE: An animated graph environment;* **D. S. Dillon and F. R. Smietana**, *An interactive, graphical, educationally oriented graph analysis package;* **G. H. Bradley and H. F. Oliveira**, *Network assistant: To construct, test, and analyze graph network algorithms;* **K.-W. Lih, N. Dean, and M. Mihail**, *Computing spanning trees in NETPAD;* **B. M. E. Moret and H. D. Shapiro**, *An empirical assessment of algorithms for constructing a minimum spanning tree;* **C. Thomborson, B. Alpern, and L. Carter**, *Rectilinear Steiner tree minimization on a workstation;* **P. Schorn**, *The XYZ GeoBench for the experimental evaluation of geometric algorithms;* **D. A. Berque and M. K. Goldberg**, *Monitoring an algorithm's execution;* **T.-S. Hsu, V. Ramachandran, and N. Dean**, *Implementation of parallel graph algorithms on the MasPar;* **A. L. Buchsbaum and M. Mihail**, *Monte Carlo and Markov chain techniques for network reliability and sampling;* **D. D. Harms, J. S. Devitt, and C. J. Colbourn**, *Networks and reliability in MAPLE;* **G. Zimmerman, A. H. Esfahanian, and D. Vasquez**, *GMP/X, An X-windows based graph manipulation package;* **C. Gomez and M. Goursat**, *METANET: A system for network analysis;* **V. J. Leung, M. B. Dillencourt, and A. L. Bliss**, *GraphTool: A tool for interactive design and manipulation of graphs and graph algorithms;* **M. Krishnamoorthy, A. Suess, M. Onghena, F. Oxaal, and T. Spencer**, *Improvements to GraphPack: A system to manipulate graphs and digraphs;* **J. I. Helfman and J. L. Gross**, *Extending a graph browser for topological graph theory;* **L. A. Sanchis**, *Test case construction for the vertex cover problem;* **M. Delest and N. Rouillon**, *CalICo: Software for combinatorics;* **M. Delest**, *Formal calculus and enumerative combinatorics;* **K. Sutner**, *Implementing finite state machines;* **D. Caugherty and S. H. Rodger**, *NPDA: A tool for visualizing and simulating nondeterministic pushdown automata;* **I. J. Dejter**, *Recognizing the hidden structure of Cayley graphs;* **D. Möller and R. Müller**, *A concept for the representation of data and algorithms.*

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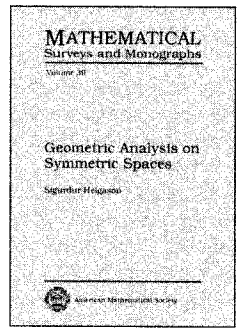
MATHEMATICAL SURVEYS AND MONOGRAPHS



Geometric Analysis on Symmetric Spaces

Sigurdur Helgason

Volume 39

Among Riemannian manifolds, symmetric spaces (in the sense of Cartan) provide an abundant supply of elegant examples, the structures of which are enhanced by the rich theory of semisimple Lie groups. On these spaces, global analysis, particularly integration theory and partial differential operators, arises in a natural way by the requirement of geometric invariance. In Euclidean space these two subjects are related by the Fourier transform. The Peter-Weyl theory for compact groups, and Cartan's refinement of it, provides a way to develop harmonic analysis on compact symmetric spaces. The noncompact symmetric spaces, however, present a multitude of new and natural problems. This book is devoted to geometric analysis on noncompact Riemannian spaces. Known for his high-quality expositions, Helgason received the 1988 AMS Steele Prize for Expository Writing for books on differential geometry, Lie groups, and symmetric spaces. The exposition in this book is easily accessible to readers with modest background in semisimple Lie group theory. In particular, familiarity with representation theory is not needed.

Contents

A duality in integral geometry; A duality for symmetric spaces; The Fourier transform on a symmetric space; The Radon transform on X and on X_o. Range questions; Differential equations on symmetric spaces; Eigenspace representations; Solutions to exercises; Bibliography.

1991 *Mathematics Subject Classification*: 43A85, 53C35, 22E46, 22E30, 43A90, 44A12, 32M15; 53C65, 58G35, 31A20, 43A35, 35L05
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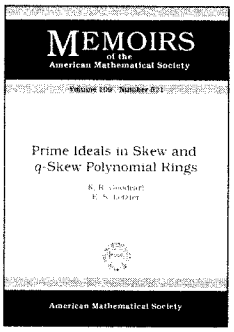

Prime Ideals in Skew and q-Skew Polynomial Rings

K. R. Goodearl and E. S. Letzter

Volume 109, Number 521

There has been continued interest in skew polynomial rings and related constructions since Ore's initial studies in the 1930s. New examples not covered by previous analyses have arisen in the current study of quantum groups. The aim of this work is to introduce and develop new techniques for understanding the prime ideals in skew polynomial rings $S = R[y; \tau, \delta]$, for automorphisms τ and τ-derivations δ of a noetherian coefficient ring R. Goodearl and Letzter give particular emphasis to the use of recently developed techniques from the theory of noncommutative noetherian rings. When R is an algebra over a field k on which τ and δ act trivially, a complete description of the prime ideals of S is given under the additional assumption that $\tau^{-1}\delta\tau = q\delta$ for some nonzero $q \in k$. This last hypothesis is an abstraction of behavior found in many quantum algebras, including q-Weyl algebras and coordinate rings of quantum matrices, and specific examples along these lines are considered in detail.

Contents

Introduction; Preliminaries for $S = R[y; \tau, \delta]$; Tau-delta-prime coefficient rings; Each prime ideal of S is associated to a unique τ-orbit in spec R; Annihilator primes and induced bimodules; Prime ideals in quadratic (-1)-skew extensions; Prime ideals in S associated to infinite orbits. The general case; Prime ideals in S associated to infinite orbits. The q-skew case; Prime ideals in S associated to finite orbits. The general case; Prime ideals in S associated to finite orbits. The q-skew case; Classification of prime ideals in q-skew extensions; Irreducible finite dimensional representations of q-skew extensions; Quantized Weyl algebras; Prime factors of coordinate rings of quantum matrices; Chains of prime ideals in iterated Ore extensions; References.

1991 *Mathematics Subject Classification*: 16D30, 16P40, 16S36
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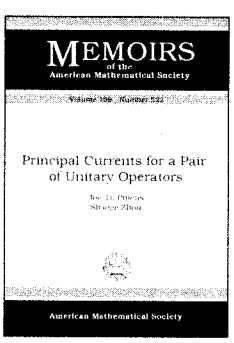

Principal Currents for a Pair of Unitary Operators

Joel D. Pincus and Shaojie Zhou

Volume 109, Number 522

Principal currents were invented to provide a noncommutative spectral theory in which there is still significant localization. These currents are often integral and are associated with a vector field and an integer-valued weight which plays the role of a multi-operator index. The study of principal currents involves scattering theory, new geometry associated with operator algebras, defect spaces associated with Wiener-Hopf and other integral operators, and the dilation theory of contraction operators. This monograph explores the metric geometry of such currents for a pair of unitary operators and certain associated contraction operators. Applications to Toeplitz, singular integral, and differential operators are included.

Contents

Introduction; The geometry associated with eigenvalues; The dilation space solution of the symbol Riemann Hilbert problem; The principal current for the operator-tuple $\{P_1, P_2, W_1, W_2\}$; Estimates; The criterion for eigenvalues; The $N(\omega)$ operator; The characteristic operator function of T_1; Localization and the "cut-down" property; The joint essential spectrum; Singular integral representations; Toeplitz operators with unimodular symbols; C_{11}-Contraction operators with (1, 1) *deficiency indices; Appendix A; Appendix B; Appendix C; References.*

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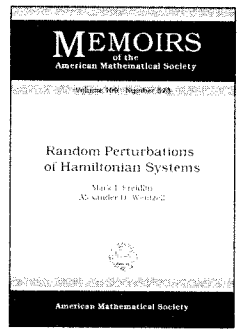

Random Perturbations of Hamiltonian Systems

Mark I. Freidlin and Alexander D. Wentzell

Volume 109, Number 523

Random perturbations of Hamiltonian systems in Euclidean spaces lead to stochastic processes on graphs, and these graphs are defined by the Hamiltonian. In the case of white-noise type perturbations, the limiting process will be a diffusion process on the graph. Its characteristics are expressed through the Hamiltonian and the characteristics of the noise. Freidlin and Wentzell calculate the process on the graph under certain conditions and develop a technique which allows consideration of a number of asymptotic problems. The Dirichlet problem for corresponding elliptic equations with a small parameter are connected with boundary problems on the graph.

Contents

Introduction; Main results; Proof of Theorem 2.2; Proofs of Lemmas 3.2, 3.3, 3.4; Proof of Lemma 3.5; References.

1991 *Mathematics Subject Classification*: 60J60, 60F17, 35B40, 34C29, 34F05
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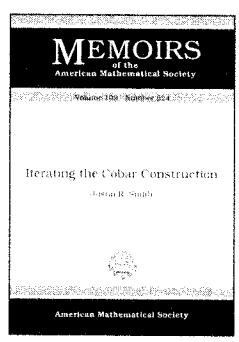

Iterating the Cobar Construction

Justin R. Smith

Volume 109, Number 524

This book develops a new topological invariant called the m-structure, which incorporates all information contained in the canonical coproduct and the Steenrod operations. Given a chain complex equipped with an m-structure, Smith shows that its cobar construction also has a natural m-structure. This derived m-structure of the cobar construction corresponds to the m-structure of the loop space of the original space under the map that carries the cobar construction to the loop space. This result allows one to form iterated cobar constructions which Smith

shows are homotopy equivalent to iterated loop spaces. These results are applied to the computation of the cohomology algebra structure of total spaces of fibrations.

Contents

Introduction; m-coalgebras; The bar and cobar constructions; Fibrations and twisted tensor products; Appendices; Bibliography.

1991 *Mathematics Subject Classification*: 55S45; 55M99
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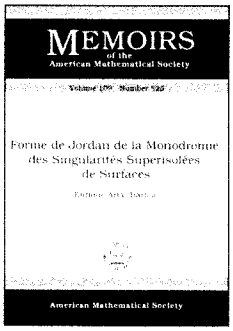

Forme de Jordan de la Monodromie des Singularités Superisolées de Surfaces

Enrique Artal-Bartolo

Volume 109, Number 525

In this work, Artal-Bartolo calculates the Jordan form of the monodromy of surface superisolated singularities, using mixed Hodge structure. The main step in this computation is to present explicitly an embedded resolution for this family. It turns out that the topology of these singularities is sufficiently complicated to produce counterexamples to a conjecture of Yau, using the theory of projective plane curves.

Contents

Introduction; Forme de Jordan et SHM; Les singularités superisolées; Le deuxième polynôme de Jordan; Le premier polynôme de Jordan; Références bibliographiques.

1991 *Mathematics Subject Classification*: 14B05, 32S55; 32S35, 32S50
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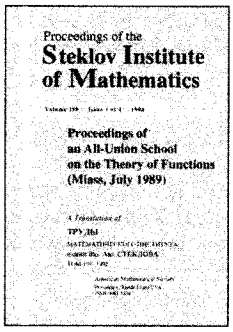

Proceedings of an All-Union School on the Theory of Functions (Miass, July 1989)

S. B. Stechkin, Editor

Volume 198

This volume contains papers presented at the All-Union School on the Theory of Functions, held in Miass in July 1989. The papers examine topical trends in the theory of functions and their approximation. Among the topics included are extremal properties of functions, approximation and interpolation of functions by trigonometric polynomials and splines, widths of function classes, best approximation of operators, cubature formulas, and classical problems of analytic number theory.

Contents

V. V. Arestov, *Best approximation of translation invariant unbounded operators by bounded linear operators;* **M.-B. A. Babaev**, *On the order of approximation of the Sobolev class W_q^r by bilinear forms in L_p for $1 \le q \le 2 \le p \le \infty$;* **V. M. Badkov**, *Asymptotic and extremal properties of orthogonal polynomials in the presence of singularities in the weight;* **Yu. S. Vasil'ev**, *Approximation by splines on an infinite interval;* **S. V. Konyagin**, *On estimates of Gaussian sums and Waring's problem for a prime modulus;* **O. V. Matveev**, *Spline interpolation of functions of several variables, and bases in Sobolev spaces;* **A. V. Reztsov**, *On errors of parallelepiped cubature formulas on classes of differentiable functions;* **V. V. Tarkaev**, *On divergence of Fourier series in rearranged Price systems;* **D. S. Telyakovskiĭ**, *On asymptotically monogenic functions;* **S. A. Telyakovskiĭ**, *On approximation of differentiable functions of high smoothness by Fourier sums;* **N. N. Kholshchevnikova**, *On some thin sets in the theory of functions and topology;* **I. G. Tsar'kov**, *Widths and an inequality of Jackson type for abstract functions;* **N. I. Chernykh**, *Jackson's inequality in $L_p(0, 2\pi)$ $(1 \le p < 2)$ with sharp constant;* **V. T. Shevaldin**, *Lower estimates of the widths of some classes of periodic functions.*

1991 *Mathematics Subject Classification*: 11L05, 11P05, 30A05, 33C45, 41–XX, 42A10, 42A20, 46E35
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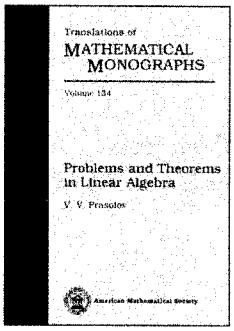

Problems and Theorems in Linear Algebra

V. V. Prasolov

Volume 134

New results in linear algebra appear constantly, as do new, simpler, and better proofs of old results. Many linear algebra results obtained in the past thirty years are accessible to undergraduate mathematics majors, but are usually ignored by textbooks. In addition, more than a few interesting old results are not covered in many books. In this book, Prasolov provides the basics of linear algebra, with an emphasis on new results and on nonstandard and interesting proofs. This book features about 230 problems with complete solutions. It would be an excellent supplementary text for an undergraduate or graduate algebra course.

Contents

Main notations and conventions; Determinants; Linear spaces; Canonical forms of matrices and linear operators; Matrices of special form; Multilinear algebra; Matrix inequalities; Matrices in algebra and calculus; Appendix; Bibliography; Subject index.

1991 *Mathematics Subject Classification*: 15–01
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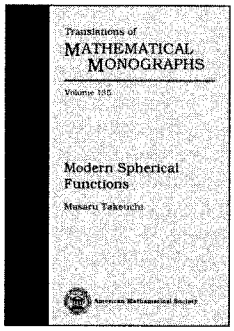

Modern Spherical Functions

Masaru Takeuchi

Volume 135

This book presents an exposition of spherical functions on compact symmetric spaces, from the viewpoint of Cartan-Selberg. Representation theory, invariant differential operators, and invariant integral operators play an important role in the exposition. Takeuchi treats compact symmetric pairs, spherical representations for compact symmetric pairs, the fundamental groups of compact symmetric spaces, and the radial part of an invariant differential operator. Also explored are the classical results for spheres and complex projective spaces and the relation between spherical functions and harmonic polynomials. This book is suitable as a graduate textbook.

Contents

Introduction; Spherical functions; Compact symmetric pairs; Spherical functions on spheres and on complex projective spaces; Appendix; References; Subject index; Notation index.

1991 *Mathematics Subject Classification*: 43–01; 53C35, 43A90
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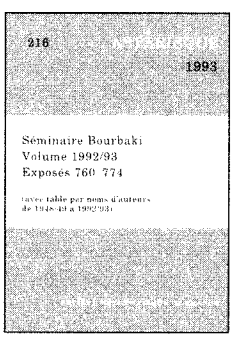

Séminaire Bourbaki, Volume 1992/93, Exposés 760–774

Volume 216

Comme les précédents volumes de ce Séminaire, celui-ci contient quinze exposés de synthèse sur des sujets d'actualité: sept exposés de géométrie ou de topologie, un de calcul stochastique, deux sur les polylogarithmes, un de géométrie arithmétique, deux d'analyse, un de théorie des systèmes dynamique, et un de théorie des groupes. On y trouve en particulier les résultats récents sur les invariants des noeuds, les orbites périodiques dans le problème des trois corps, le nombre de points des variétés de Shimura, et la monodromie des systèmes différentiels linéaires.

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Novembre 1992: **E. Giroux**, *Topologie de contact en dimension* 3 [*autour des travaux de Yakov Eliashberg*]; **P.-A. Meyer**, *Progrès récents en calcul stochastique quantique;* **J. Oesterlé**, *Polylogarithmes;* **J.-J. Risler**, *Construction d'hypersurfaces réelles* [*d'après Viro*]; **G. Skandalis**, *Algébres de von Neumann de groupes libres et probabilités non commutatives* [*d'après Voiculescu etc.*]; **Mars 1993**: **A. Beauville**, *Monodromie des systèmes différentiels linéaires à pôles simples sur la sphère de Riemann* [*d'après A. Bolibruch*]; **L. Clozel**, *Nombre de points des variétés de Shimura sur un corps fini* [*d'après R. Kottwitz*]; **P. Gauduchon**, *Variétés riemanniennes autoduales* [*d'après C. H. Taubes et al.*]; **E. Looijenga**, *Intersection theory on Deligne-Mumford compactifications* [*after Witten and Kontsevich*]; **P. Vogel**, *Invariants de Vassiliev des noeuds* [*d'après D. Bar-Natan, M. Kontsevich, et V. A. Vassiliev*]; **Juin 1993**: **D. Bennequin**, *L'instanton gordien* [*d'après P. B. Kronheimer et T. S. Mrowka*]; **M. Berger**, *Systoles et applications selon Gromov;* **J.-L. Cathelineau**, *Homologie du groupe linéaire et polylogarithmes* [*d'après A. B. Goncharov et d'autres*]; **M. Ledoux**, *Inégalités isopérimétriques en analyse et probabilités;* **C. Viterbo**, *Orbites périodiques dans le problème des trois corps.*

1991 *Mathematics Subject Classification*: 53C15, 57M50, 57R15, 57R30, 81S25, 11R42, 19F27, 33E20, 14M25, 14P25, 46L50, 46L10, 46L35, 60F99, 34A20, 14D05, 11S40, 14G13, 11S37, 14F30; 53A30, 53B21, 53C20, 53C21, 58G03, 53G05, 14D20, 14H10, 57M25, 57N10, 14Fxx, 14Jxx, 35Jxx, 35Qxx, 51Hxx, 52Cxx, 55Nxx, 55Rxx, 57Mxx, 58Gxx, 52A40, 53Cxx, 53C65, 11R42, 14G10, 14M15, 19Dxx, 19Exx, 19F27, 20Gxx, 28A75, 28C20, 46B20, 49G15, 52A40, 58G11, 60B12, 60E15, 60G15, 70F07
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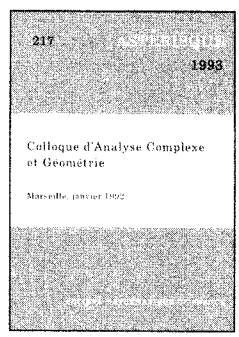

Colloque d'Analyse Complexe et Géométrie

Volume 217

This volume contains papers presented at the Colloque d'Analyse Complexe et Géométrie, held at the Centre International de Rencontres Mathématiques in Marseille in January 1992. This conference brought together specialists from different areas of analysis and complex geometry. One of the central themes was the problem of extension of holomorphic objects. Some of the papers present surveys of certain topics, such as residues, the $\bar{\partial}$-Neuman problem, the problem of extension and separated analyticity, and the extension of Cauchy-Riemann functions. Other papers deal with a variety of subjects and exhibit links between complex analysis and other fields, including topology, partial differential equations, and differential geometry.

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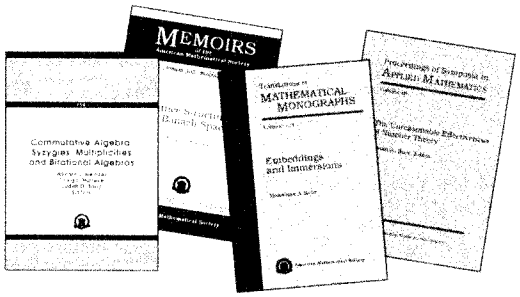

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Eighteen Papers on Statistics and Probability, 1981, 317 pp.
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Fourteen Papers on Statistics and Probability, 1985, 138 pp.
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SIAM-AMS Proceedings

Mathematical Aspects of Electrical Network Analysis, edited by Frank Harary and Herbert S. Wilf, 1971, 206 pp.
SIAMS/3WS $37 $11

Mathematical Psychology and Psychophysiology, edited by Stephen Grossberg, 1981, 318 pp.
SIAMS/13WS $49 $15

Translations of Mathematical Monographs

Expansions in Eigenfunctions of Selfadjoint Operators, by Ju. M. Berezanskiĭ, 1968, 809 pp.
MMONO/17WS $92 $28

Direct and Inverse Imbedding Theorems, by L. D. Kudrjavcev, 1974, 206 pp.
MMONO/42WS $66 $20

Introduction to the Theory of Entire Functions of Several Variables, by L. I. Ronkin, 1974, 273 pp.
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Systems of Quasilinear Equations and Their Applications to Gas Dynamics, by B. L. Roždestvenskiĭ and N. N. Janenko, 1983, 676 pp.
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Lattices with Unique Complements, by V. N. Saliĭ, 1988, 113 pp.
MMONO/69WS $63 $19

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Space Mappings with Bounded Distortion, by Yu. G. Reshetnyak, 1989, 362 pp.
MMONO/73WS $150 $45

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Volume 1: The Statistics CumIndex, by James L. Dolby and John W. Tukey, 1973, 498 pp.
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Volumes 3 and 4: Index to Statistics and Probability: Permuted Titles, by Ian C. Ross and John W. Tukey, 1975, 2384 pp.
TUKEY/3/4WS $147 $44

Volume 5: Index to Statistics and Probability: Locations and Authors, by Ian C. Ross and John W. Tukey, 1973, 1092 pp.
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AMS Reports and Communications

The January Meeting in Cincinnati

The January 1994 Joint Mathematics Meetings, including the 100th annual meeting of the American Mathematical Society, the 77th annual meeting of the Mathematical Association of America, and the 1994 annual meetings of the Association for Women in Mathematics and of the National Association of Mathematicians, were held January 12–15 (Wednesday–Saturday), 1994, in Cincinnati, Ohio. Scientific sessions took place in the Cincinnati Convention Center, the Clarion Hotel Cincinnati, and the Hyatt Regency Cincinnati. There were 3,463 registrants, including 2,373 members of the Society.

AMS-MAA Invited Addresses. By invitation of the AMS-MAA Joint Program Committee, four speakers addressed the AMS and MAA on history or developments of mathematics. The speakers, their affiliations and titles were: GEORGIA M. BENKART, University of Wisconsin, Madison, *A tale of two groups*; SUBRAHMANYAN CHANDRASEKHAR, Lab Astrophys & Space Research and University of Chicago, *Some propositions from Newton's Principia*; LÁSZLÓ LOVÁSZ, Eötvös Loránd Tudományegyetem (Budapest, Hungary), and Princeton University, *Random walks and volume*; and KENNETH A. RIBET, University of California, Berkeley, *Overview and update on Fermat's last theorem*. They were introduced by Richard A. Brualdi, Richard A. Askey, Laszlo Babai, and Barry Mazur, respectively.

Sixty-seventh Josiah Willard Gibbs Lecture. ROBERT C. MAY of Oxford University presented the 1994 lecture. It was entitled *Necessity and chance: deterministic chaos in ecology and evolution*. Ronald L. Graham, President of the Society, introduced Professor May.

Retiring Presidential Address. MICHAEL ARTIN, Massachusetts Institute of Technology, delivered his Retiring Presidential Address on *Noncommutative projective geometry*. Ronald L. Graham introduced Ex-president Artin.

Colloquium Lectures. A series of three Colloquium Lectures was delivered by JEAN BOURGAIN, of IHES and the University of Illinois, Urbana-Champaign, on the topic *Harmonic analysis and nonlinear evolution equations*. Presiding at the lectures were Ronald L. Graham, Ivar Stakgold, and Earl R. Berkson.

Invited Addresses. By invitation of the AMS Program Committee for National Meetings, there were five fifty-minute invited addresses. The speakers, their affiliations, and the titles of their talks were: JACQUES C. HURTUBISE, McGill University, *Particle configurations, instantons, and holomorphic maps*; JAMES M. HYMAN, Los Alamos National Laboratory, *The fundamental role of solitons in nonlinear dispersive PDE's*; CARL POMERANCE, University of Georgia, *Carmichael numbers*; GILBERT STRANG, Massachusetts Institute of Technology, *Wavelets, filters, and unitary matrices*; and RUTH J. WILLIAMS, University of California, San Diego, *Reflecting Brownian motions*. They were introduced by Benjamin M. Mann, Peter D. Lax, Ronald L. Graham, Peter D. Lax, and Philip E. Protter, respectively.

Special Sessions. By invitation of the same committee, there were nineteen special sessions of selected twenty-minute papers. The topics and the names and affiliations of the organizers were as follows:

Topology of High Dimensional Manifolds, FREDRIC D. ANCEL, University of Wisconsin, Milwaukee;

History of Mathematics, W. THOMAS ARCHIBALD, Acadia University, and VICTOR J. KATZ, University of the District of Columbia;

Algebraic Topology and Dynamical Systems, ROBERT BROWN, University of California, Los Angeles, CHRISTOPHER K. MCCORD, University of Cincinnati, and KONSTANTIN MISCHAIKOW, Georgia Institute of Technology;

Undergraduate Research in Mathematics, DAVID C. CAROTHERS, Hope College, and GERARD A. VENEMA, Calvin College;

Meetings of Mathematicians, BETTYE ANNE CASE, Florida State University;

Singular Boundary Value Problems, PAUL W. ELOE, University of Dayton;

Operator Theory, Nonself Adjoint Operator Algebras, and Control Theory, ARTHUR E. FRAZHO, Purdue University, and GARY WEISS, University of Cincinnati;

Representation Theory and Harmonic Analysis, KENNETH I. GROSS, University of Vermont, DONALD ST. P. RICHARDS, University of Virginia, and PAUL J. SALLY, University of Chicago;

C^*-algebras and von Neumann Algebras, HERBERT HALPERN, VICTOR G. KAFTAL, and SHUANG ZHANG, University of Cincinnati;

Quasiconformal Mappings in Analysis, DAVID A. HERRON, University of Cincinnati, and SUSAN G. STAPLES, College of Staten Island, CUNY;

Geometry and Topology of Moduli Spaces, JACQUES C. HURTUBISE, McGill University;

Geometric Applications of Operator Algebras and Index Theory, JEROME KAMINKER, Indiana University-Purdue University at Indianapolis;

Modern Methods in Continuum Theory, KRYSTYNA M. KUPERBERG and PIOTR MINC, Auburn University;

Quadratic Forms and Division Algebras, DAVID B. LEEP, University of

Kentucky, DANIEL B. SHAPIRO, Ohio State University, and TARA L. SMITH, University of Cincinnati;

Advances in Function Theoretic Methods, PETER A. MCCOY, U. S. Naval Academy;

Stochastic Analysis, PHILIP E. PROTTER, Purdue University;

Scientific Computing, SEENITH SIVASUNDARAM, Embry-Riddle Aeronautical University;

Wavelets and Their Applications, GILBERT STRANG, Massachusetts Institute of Technology;

Nonlinear Partial Differential Equations and Applications, HONG-MING YIN, Notre Dame University.

AMS-MAA Special Session. By invitation of the same committee and in conjunction with the MAA, there was a jointly sponsored special session of selected twenty-minute papers. The topic was *Mathematics and education reform*; the organizers and their affiliations were NAOMI FISHER and PHILIP D. WAGREICH, University of Illinois at Chicago, HARVEY B. KEYNES, University of Minnesota, Minneapolis, KENNETH C. MILLETT, University of California at Santa Barbara, and HUGO ROSSI, University of Utah.

Contributed Papers. There were thirty-three AMS sessions of contributed ten-minute papers. The following mathematicians presided at these sessions: Clinton Kolaski, Peter A. McCoy, Annalisa M. Peterson, Gal Berkooz, Bonita A. Lawrence, John D. O'Neill, David J. Foulis, Theodore P. Hill, Mark B. McKinzie, Jon M. Clauss, Ron Brown, Neil Hindman, B. E. Peterson, Charles Holly, Peter A. Loeb, Gordon A. Swain, John Gregory, Cynthia E. Trimble, John A. Morrison, Francis A. Arlinghaus, Mitchell Kotler, Mark A. Smith, Thomas M. Halvarson, Daniel H. Luecking, David E. Tepper, Sanford Miller, Andrew J. Lazarus, Elinor Velasquez, Davide P. Cervone, Lance Barnett, Carl D. Mueller, T. Jiang, James R. Hughes, Thomas I. Ivey, David Fisher, Osvaldo Marrero, Julie Kerr, Oved Shisha, Robert E. Leduc, Benjamin J. Ford, William Lundgren, G. Beate Zimmer, Warren Johnson, Ruth Meyer, Frank P. Weber, Lokenath Debnath, T. K. Puttaswamy, Matt D. Lunsford, Larry J. Langley, Michael Monticino, Sebron C. Dale, Tzu-Chu Lin, Thomas McKenzie, A. Richmond, George Baloglou, John Jones, J. W. Neuberger, John Harrison, J. B. Garner, Don Redmond, John Cook, Andrew Mathas, David Skoug, William Feldman, Mark E. Huibregtse, Scott H. Hochwald, Malcolm Goldman, Rickey A. Kolb, J. Marshall Ash, Joyati Debnath, Ronald J. Knill, D. A. Robbins, Lawrence Crone, Bernard Harris, John McCleary, Matthew B. Stenzel, Michael J. Spurr, Alfredo J. Julian, Neal Brand, Gilbert G. Walter, Peter Brown, Luise-Charlotte Kappe, Douglas Harris, Michael Prophet, Francis D. Lonergan, Evelyn L. Hart, T. Christine Stevens, Jeffrey Lawson, Susan Addington, Kevin Strobel, A. Witt, Kevin Ford, Stephen G. Landry, Michael L. Johnson, and W. Christopher Lang.

Science Policy Address. NEAL LANE, Director of the National Science Foundation, delivered a one-hour public policy address. His talk was cosponsored by the Joint Policy Board for Mathematics (JPBM) and the Science Policy Committees of the AMS, MAA, and SIAM.

Committee. David Styer of the University of Cincinnati served as chair of the Local Arrangements Committee.

Robert J. Daverman
Associate Secretary
Knoxville, Tennessee

The 890th Meeting in Lexington, Kentucky

The 890th meeting of the Society was held in Lexington, Kentucky, on the University of Kentucky campus on March 18–19, 1994. There were 243 registrants, including 173 members of the Society.

Invited Addresses. By invitation of the Southeastern Section Program Committee, there were four invited speakers. The speakers, their affiliations, and their titles were as follows: JACK J. DONGARRA, Oak Ridge National Laboratory and University of Tennessee, *Recent work in parallel algorithms for linear algebra*; JAMES E. MCCLURE, Purdue University, *Applications of Hochschild and André-Quillen homology to homotopy theory*; GEORGE F. MCNULTY, University of South Carolina, *Avoiding combinatorial patterns in strings of symbols*; and DAVID R. MORRISON, Duke University, *Mirror symmetry and the quantum moduli space of Calabi-Yau manifolds*.

The speakers were introduced by Carl W. Lee, Mark Hovey, Karen Collins, and Ron Donagi, respectively.

Special Sessions. By invitation of the same committee, there were ten special sessions of selected twenty-minute papers. The topics of the sessions and the names and affiliations of the organizers were as follows:

Elliptic Genera and Elliptic Cohomology, SERGE OCHANINE, University of Kentucky.

Geometric Group Theory and Metric Geometry, PHILIP L. BOWERS, Florida State University.

Graph Theory, KAREN COLLINS, Wesleyan University, and EWA KUBICKA, University of Louisville.

Homotopy Theory, MARK HOVEY, University of Kentucky, and JAMES E. MCCLURE, Purdue University.

Infinite Groups and Group Rings, JAMES C. BEIDLEMAN and DONALD B. COLEMAN, University of Kentucky.

Inverse Spectral Problems: Theory and Computation, PETER D. HISLOP and PETER A. PERRY, University of Kentucky.

Mathematics of Many-Body Quantum Theory, M. BETH RUSKAI, University of Massachusetts at Lowell.

Partial Differential Equations and Minimal Smoothness Condition, RUSSEL BROWN and JOHN LEWIS, University of Kentucky, and ZHONG-WEI SHEN, Purdue University.

Quantum Algebraic Geometry, DAVID R. MORRISON, Duke University.

Workshop Based Calculus Interventions, MICHAEL B. FREEMAN, University of Kentucky.

Contributed Papers. The general session of contributed papers was chaired by Raymond H. Cox.

Committee. Raymond H. Cox of the University of Kentucky ably and efficiently supervised local arrangements.

Robert J. Daverman
Associate Secretary
Knoxville, Tennessee

Miscellaneous

Personals

Christian Berg, of the University of Copenhagen, has been elected president of the Danish Mathematical Society for 1994–1995.

David M. Bressoud, of Penn State University, was appointed professor in mathematics and computer science at Macalester College, St. Paul, MN, effective September 1, 1994.

The trustees of the Rollo Davidson Trust have awarded Rollo Davidson Prizes for 1994 to **Thomas S. Mountford**, of the University of California at Los Angeles, for his work on interacting particle systems; and to **Laurent Saloff-Coste**, of the Université Paul Sabatier (Toulouse), for his work on rates of convergence for Markov chains and random walks on finite groups.

Deaths

George A. W. Boehm, of New York, NY, died on October 7, 1993. He was born on August 3, 1922, and was a member of the Society for 34 years.

Richard E. Chamberlin, of Salt Lake City, UT, died on March 14, 1994. He was born on March 20, 1923, and was a member of the Society for 46 years.

Edward J. Hannan, retired professor from the Australian National University, died on January 7, 1994. He was born on January 29, 1921, and was a member of the Society for 28 years.

William E. Hartnett, retired professor from the State University of New York at Plattsburgh, died on October 14, 1993. He was born on October 25, 1925, and was a member of the Society for 39 years.

Emerson D. Jenkins, professor emeritus of Kent State University, died on March 14, 1994. He was born in January 1909 and was a member of the Society for 59 years.

Fritz John, professor emeritus of the Courant Institute of New York University, died on February 24, 1994. He was born in June 1910 and was a member of the Society for 58 years.

Stephen C. Kleene, professor emeritus of the University of Wisconsin at Madison, died on January 25, 1994. He was born on January 5, 1909, and was a member of the Society for 60 years.

Alfred Raymond Manwell, Oakington, England, died on January 11, 1994. He was born on August 23, 1920, and was a member of the Society for 11 years.

Ethel Ward McLemore, of Dallas, TX, died on January 12, 1994. She was born on January 2, 1908, and was a member of the Society for 31 years.

Joseph Milkman, retired professor of mathematics from the U.S. Naval Academy, died on February 25, 1994. He was born on November 25, 1912, and was a member of the Society for 44 years.

John I. Nassar, senior professor at Muhlenberg College, died on January 18, 1994. He was born on June 2, 1927, and was a member of the Society for 15 years.

George W. Reitwiesner, retired computer expert of Silver Spring, Maryland, died on December 27, 1993. He was born on May 27, 1918, and was a member of the Society for 43 years.

Hans-Egon Richert, of Blaustein, Germany, died on November 25, 1993. He was born on June 2, 1924, and was a member of the Society for 37 years.

Leon C. Robbins, Jr., of Villanova University, died on December 19, 1993. He was born on March 4, 1923, and was a member of the Society for 40 years.

Hans Rohrbach, professor emeritus of Johannes Gutenberg University, Mainz, Germany, died on December 19, 1993. He was born on February 27, 1903, and was a member of the Society for 35 years.

John M. Smith, of George Mason University, died on February 25, 1994. He was born on April 16, 1937, and was a member of the Society for 29 years.

William F. Steele of Tiffin, Ohio, died on December 24, 1993. He was born on March 14, 1920, and was a member of the Society for 37 years.

Wim Vervaat, of the University of Lyon I, died on January 31, 1994. He was born on July 15, 1942, and was a member of the Society for 19 years.

Edward T. Wong, professor emeritus of Oberlin College, died on December 26, 1993. He was born on December 21, 1928, and was a member of the Society for 39 years.

Erratum

Henrik H. Martens was incorrectly reported as having died on October 10, 1993. The actual date was October 12, 1993.

Visiting Mathematicians

The list of visiting mathematicians includes both foreign mathematicians visiting in the United States and Canada, and Americans visiting abroad. Note that there are two separate lists.

American Mathematicians Visiting Abroad

Name and Home Country	Host Institution	Field of Special Interest	Period of Visit
Fang, S.-C. (U.S.A.)	National Cheng-kung University, Taiwan, R.O.C.	Mathematical Programming	5/94 – 6/94
Gokhale, D. V. (U.S.A.)	University of Pooma, India	Information Theory Non-parametric Inference	1/94 – 9/94
Lewis, Roger T. (U.S.A.)	University of Oslo, Norway	Partial Differential Equations, Ordinary Differential Equations	1/95 – 6/95
Saito, Yoshimi (U.S.A.)	University of Heidelberg, Germany	Differential Operators, Mathematical Physics	9/94 – 3/95
Schonmann, Roberto (U.S.A.)	University of Rome, Italy	Probability, Mathematical Physics	9/94 – 12/94
Simmonds, James G. (U.S.A.)	University of Paris VI, France	Structural Mechanics	9/94 – 6/95
Wang, Y. H. (Canada)	Tunghai University, Taiwan, R.O.C.	Probability and Statistics	9/94 – 5/95

Visiting Foreign Mathematicians

Alencar, Raymundo (Brazil)	Kent State University	Functional Analysis	1/95 – 6/95
Aulaskari, Rauno (Finland)	University of Hawaii	Function Theory	10/93 – 12/94
Barbu, Viorel (Romania)	Ohio University	Optimal Control of Partial Differential Equations	12/94 – 6/95
Benjamin, T. Brooke (United Kingdom)	Pennsylvania State University	Fluid Dynamics	8/94 – 3/95
Berestovskii, Valerii N. (Russia)	University of Tennessee, Knoxville	Differential Geometry	8/94 – 12/94
Cheng, Philip E. (Taiwan, R.O.C.)	Harvard University	Non-parametric Statistics, Biostatistics, Semi-parametric Statistical Modeling	8/94 – 7/95
Dougalis, Vassilios A. (Greece)	University of Tennessee, Knoxville	Numerical Analysis, Differential Equations	8/94 – 12/94
Eichhorn, Jürgen (Germany)	Emory University	Geometric Analysis	9/94 – 10/94
Fu, Hung-Lin (Republic of China)	Auburn University	Design and Graph Theory	8/94 – 8/95
Goryunov, Victor (Russia)	University of Georgia	Topology	1/94 – 6/94
Grace, S. R. (Egypt)	University of Saskatchewan	Ordinary Differential Equations	7/94 – 8/94
Grimmet, Geoffrey (England)	University of Utah	Applied Mathematics	4/95 – 7/95
Hejny, Milan (Czech Republic)	Concordia University, Montreal	Mathematics Education	5/94 – 6/94
Held, Martin (Austria)	State University of New York at Stony Brook	Computational Geometry	9/93 – 7/95
Hernandez, Eugenio (Spain)	Washington University, St. Louis	Wavelet Theory	9/94 – 1/95
Herzog, Marcel (Israel)	University of Hawaii	Group Theory	8/94 – 7/95
Jadczyk, Arkadiusz (Poland)	University of Florida	Mathematical Physics	9/94 – 9/94
Kaniuth, Eberhard (Germany)	University of Saskatchewan	Harmonic Analysis	9/94 – 12/94
Karonski, Michal (Poland)	Emory University	Probability and Discrete Mathematics	9/94 – 12/94
Kim, Hee-Jae (Korea)	University of Georgia	Statistical Computing	2/94 – 2/95

Name and Home Country	Host Institution	Field of Special Interest	Period of Visit
Kim, Taeboo (Korea)	Pennsylvania State University	Differential Equations	8/94 – 2/95
Lindstrom, Michael (Finland)	Kent State University	Functional Analysis	1/95 – 6/95
Low, Lewis (Australia)	Illinois State University	Number Theory, Combinatorics	8/94 – 12/94
Malone, John (Australia)	Illinois State University	Mathematics Education	10/94 – 11/94
Maruyama, Ken-ichi (Japan)	Memorial University of Newfoundland	Algebraic Topology	10/94 – 7/95
Matveev, V. B. (Russia)	Clarkson University	Solitons	9/94 – 10/94
Mori, Shigefumi (Japan)	University of Utah	Algebraic Geometry	4/95 – 6/95
Mundruczo, Gyorgy (Hungary)	University of New Hampshire	Statistics	8/92 – 8/94
Nordstrom, Kenneth (Finland)	University of Maryland, Baltimore County	Statistics	9/94 – 8/95
Ponenti, Pierrejean (France)	Washington University, Saint Louis	Wavelet Theory	9/94 – 12/94
Ptak, Marek (Poland)	University of Georgia	Analysis	9/93 – 6/94
Rubin, M. (Israel)	Bowling Green State University	Logic and Algebra	8/94 – 12/94
Saber, Hashim (Iraq)	University of Montana	Numerical Analysis	8/93 – 7/94
Schmidt, E. Tamas (Hungary)	University of Manitoba	Universal Algebra	6/94 – 7/94
Sen, Rathin (Israel)	Concordia University, Montreal	Mathematical Physics	8/94 – 9/94
Seneta, Eugene (Australia)	The University of Chicago	Statistics	10/94 – 12/94
Serre, Jean-Pierre (France)	Harvard University	Number Theory	10/94 – 12/94
Shapiro, Leonid (Russia)	University of Manitoba	Topology	5/94 – 6/94
Shin, Jong Moon (Korea)	Pennsylvania State University	Topology Semigroup/Algebra	8/94 – 1/95
Simpson, Jamie (Australia)	Illinois State University	Number Theory, Combinatorics	7/94 – 11/94
Soria, Fernando (Spain)	Washington University, Saint Louis	Wavelet Theory	1/95 – 6/95
Spiegel, Hartmut (Germany)	Illinos State University	Mathematics Education	9/94 – 10/94
Tweddle, Ian (Scotland)	University of Florida	Functional Analysis	5/94 – 6/94
Torresani, Bruno (France)	Washington University, Saint Louis	Wavelet Theory	9/94 – 12/94
Wiegandt, Richard (Hungary)	University of Southwestern Louisiana	Algebra	1/95 – 5/95
Winther, Ragnar (Norway)	Pennsylvania State University	Numerical Analysis	8/94 – 12/94
Wysoczanski, Janusz (Poland)	University of Saskatchewan	Harmonic Analysis	1/94 – 12/94
Xu, Taixi (China)	Emory University	Integrable Systems	5/94 – 4/95
Xunwu, Cai (People's Republic of China)	University of Alabama at Birmingham	Fuzzy Logic	3/94 – 9/94
Zak, Tomasz (Poland)	University of Tennessee, Knoxville	Probability Theory	8/94 – 5/95

New Members of the AMS

ORDINARY MEMBERS

Ray V Adams, Worcester Polytechnic Institute, MA
Eaman Al-Khouja, Aleppo Univ, Syria
Michael D Allen, Wichita Falls, TX
Jorgen Ellegaard Andersen, Univ of California Berkeley
Peter Alain Antal, Eidgen Technische Hochschule, Zurich, Switzerland
Jan Awrejcewicz, Technical Univ of Lodz, Poland
Yongju Bae, Taegu National Univ of Education, Korea
David Joseph Bale, Univ of Regina, Saskatchewan, Canada
Barry Beerman, Hewlett, NY
Frank Erich Beichelt, Hilbersdorf, Germany
Edward Bishop, Arlington, MA
Dines Bjorner, Univ of Macau, Macau
Lirio Blado Gregorio, Univ of the Philippines, Quezon, Republic of Philippines
Fernando Blasco, Univ Polytechnic of Madrid, Spain
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MATHEMATICAL REVIEWS

Executive Editor

Applications and nominations are invited for the position of Executive Editor of *Mathematical Reviews* (*MR*).

The executive editor is the chief executive officer at *MR* and is responsible for all phases of its operations. These duties include:

- Direction of the editorial and consulting staff and the administration of the noneditorial staff
- Relations with reviewers and authors
- Maintenance of scientific and editorial standards
- Development and implementation of long-range plans for the *MR* Division
- Budgetary planning and control
- Overall responsibility for the timely and cost-effective production of the *MR* database and its derived products

The executive editor is assisted in administration by an associate executive editor, who is responsible for the day-to-day, non-editorial aspects of the production of *MR*. The executive editor reports to the executive director of the American Mathematical Society. The *MR* Editorial Committee provides Society overview and support in maintaining the scientific and editorial standards of *MR*.

The *MR* editorial office is located in Ann Arbor, Michigan, near the campus of the University of Michigan, and the editors enjoy many faculty privileges at the university. *MR* employs twelve associate editors, several consultants, and over sixty-five other full-time personnel. The major activity is the creation and maintenance of the *MR* database and the products derived from it, such as the MathSci CD-ROM and the paper journal.

The appointment will be for a negotiable period of from two-to-five years and should commence by January 1, 1995. The appointment has the possibility of renewal. Applications are welcomed from individuals taking leaves of absence from other positions; however, the executive editor position is full-time. Salary is negotiable and will be commensurate with experience. Generous benefits are available, including study leave.

Nominations and applications (including curriculum vitae, bibliography, data on experience, and names and addresses of at least three references) should be sent on or before July 1, 1994 to:

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

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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, or 401-455-4084 worldwide, for further information.

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POSITIONS AVAILABLE

CALIFORNIA

HUMBOLDT STATE UNIVERSITY (HSU)

Applications are invited for a temporary (one or more expected) two-year, full-time, assistant professor position beginning Fall 1994. Candidates must possess an earned doctorate in a mathematical science at the time of appointment, and must present experience or training in either mathematical modeling, statistics, or mathematics education (elementary school teacher training preferred) with a commitment to teaching excellence. HSU, located on the California north coast, has an active mathematics faculty, a strong undergraduate major, and a master's program in mathematical modeling of environmental systems. Direct inquiries to: Search Committee, Department of Mathematics, Humboldt State University, Arcata, CA 95521-8299. Application deadline 15 June 1994. HSU is an EO/AA employer.

FLORIDA

UNIVERSITY OF MIAMI
Lecturers

The Department of Mathematics and Computer Science of the University of Miami in Coral Gables, Florida, may have several full-time lecturer position openings available for fall 1994. Candidates must have a Master's degree in the mathematical sciences and outstanding teaching credentials or potential. Candidates will be responsible for teaching introductory mathematics courses. Salary will be competitive. The University of Miami is an equal opportunity affirmative action employer and a smoke/drug free workplace. Send vitae and three letters of recommendation to:

Professor A. L. Zame
Department of Mathematics
and Computer Science
University of Miami
P.O. Box 249085
Coral Gables, Florida 33124-4250

ILLINOIS

NORTHWESTERN UNIVERSITY

The Department of Mathematics, Northwestern University, invites applications for the newly created position of lecturer in mathematics. This position carries a two-course teaching responsibility in each of the three quarters of the academic year. The term of appointment will be for one year and will be renewable twice upon evidence of excellence in teaching. Candidates must have the Ph.D. degree or its equivalent and must present solid evidence of teaching excellence and the ability to communicate clearly and effectively in English. Teaching performance should be substantiated, if possible, by student evaluations. Send applications and three letters of reference to chairperson, Personnel Committee, Department of Mathematics, Northwestern University, Evanston, IL 60208-2730. Northwestern University is an Equal Opportunity/Affirmative Action employer and encourages applications from minority and women candidates.

NEW YORK

LONG ISLAND UNIVERSITY
Brooklyn Campus

Applications are invited for a tenure-track position at the assistant professor level beginning September 1, 1994. Requirements include a Ph.D. in pure mathematics (preferably in geometric topology) and a commitment to teaching with an interest in research.

Please furnish curriculum vitae and three letters of reference to Dr. S. Park, Personnel Committee, Department of Mathematics, Long Island University, University Plaza, Brooklyn, New York 11201. Long Island University is an AA/EO employer.

OHIO

OBERLIN COLLEGE

A full-time, temporary position is available at Oberlin College for the academic year 1994–95. Teaching load is five courses. Qualifications include Ph.D. in hand or expected by fall 1994, plus demonstrated interest and potential excellence in teaching. To be considered, send a letter of application, academic transcripts, curriculum vitae, and at least three letters of reference to Michael Henle, Department of Mathematics, Oberlin College, Oberlin, Ohio 44074. Consideration of applicant files will begin April 18, 1994.

TEXAS

UNIVERSITY OF TEXAS
PAN AMERICAN
Department of Mathematics
and Computer Science

Applications are invited for a tenure-track appointment at the level of assistant professor to begin August 1994. Requirements include a Ph.D. in mathematics and a strong commitment to excellence in teaching. Applicants should send a full vita and arrange to have three letters of reference sent to:

Dr. Joseph Wiener, chair of Search Committee
Department of Mathematics and Computer Science
University of Texas-Pan American
1201 W. University Drive
Edinburg, Texas 78539

Closing date for the search is May 1, 1994, or until the position is filled. The University of Texas-Pan American is an Affirmative Action, Equal Opportunity Employer.

AUSTRIA

LEOPOLD-FRANZENS-UNIVERSITÄT INNSBRUCK

An der Fakultät für Bauingenieurwesen und Architektur ist mit 1. Oktober 1995 die Planstelle einer(s)

Ordentlichen Universitätsprofessorin/
Universitätsprofessors für
Numerik und Bauinformatik

zu besetzen (Nachfolge Univ. Prof. Dr. Herbert Kremser).

Der Aufgabenbereich umfaßt die Lehre und Forschung auf dem Gebiet der Mathematik mit besonderer Betonung der Numerik und technikbezogenen Informationswissenschaften. Die Bewerberin/der Bewerber soll wissenschaftlich hervorragend ausgewiesen sein und über die Fähigkeit zur Lösung mathematischer Probleme im Bereich der technischen Wissenschaften verfügen.

Ernennungserfordenisse sind:

a) eine abgeschlossene inländische oder gleichwertige ausländische mathematische Hochschulbildung (Doktorat),

b) eine an einer österreichischen Universität erworbene oder gleichwertige ausländische mathematische Lehrbefugnis (venia docendi) oder eine gleichzuwertende wissenschaftliche Befähigung,

c) der Nachweis pädagogischer Eignung.

Da die Leopold-Franzens-Universität Innsbruck eine Anhebuhg des Anteils Der Frauen am wissenschaftlichen Personal anstrebt, werden qualifizierte Frauen ausdrücklich aufgefordert, sich zu bewerben.

Die Bewergungen sind unter Beilage des Lebenslaufes mit Beschreibung des wissenschaftlichen und beruflichen Werdeganges (Liste der wissenschaftlichen Veröffentlichungen bzw. der sonstigen wissenschaftlichen Arbeiten) sowie der Vortrags- bzw. Lehrtätigkeit an das Dekanat der Fakultät für Bauingenieurwesen und Architektur der Leopold-Franzens-Universität Innsbruck, Technikerstraße 13, A-6020 Innsbruck, bis zum 10. Juni 1994 zu richten.

CANADA

UNIVERSITY OF ALBERTA
Department of Mathematical Sciences
NSERC Women's Faculty Awards in Statistics and Mathematics

The Department of Mathematical Sciences at the University of Alberta invites outstanding applicants for nomination for Natural Sciences and Engineering Research Council of Canada Women's Faculty Awards. All areas of statistics and pure and applied mathematics will be considered. Successful applicants will receive an appointment at the assistant professor level with a reduced teaching load for five years from July 1, 1995. Candidates must be Canadian citizens or permanent residents by October 15, 1994, and be within five years of their Ph.D. degree at that date. Candidates should send a curriculum vitae, including a list of publications, and arrange for three letters of reference to be sent by August 31, 1994, to:

S. D. Riemenschneider, chairman
Department of Mathematical Sciences
University of Alberta
Edmonton, Alberta, Canada T6G 2G1

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

The Department solicits applications for a contractually-limited term appointment in geometry and complexity at the St. George (downtown) campus. The position is for the three-year period January 1, 1995, to December 31, 1998, and may be renewed for a further two years, subject to budgetary approval. Candidates should have established a strong international reputation for their research in constructive methods in algebraic geometry, including Newton polyhedra and Pfaffian functions. Duties include teaching and research, and candidates will be expected to organize and lead a research seminar in geoemtry and complexity.

Applicants should send their complete C.V. including a list of publications, and a short statement describing their research programme. They should also arrange to have at least three letters of reference sent directly to Professor S. Halperin, chair, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1. To insure full consideration, the application and all other information should be received by July 1, 1994.

In accordance with Canadian immigration requirements this advertisement is directed to Canadian citizens and permanent residents of Canada. In accordance with its Employment Equity Policy, the University of Toronto encourages applications from qualified women or men, members of visible minorities, aboriginal peoples, and persons with disabilities.

ENGLAND

UNIVERSITY OF DURHAM (England)
Chair in Pure Mathematics

Applications are invited for a Chair in Pure Mathematics in the Department of Mathematical Sciences. The appointment will commence on 1 October 1994 or such date as may be arranged.

Candidates should have an outstanding research record in a branch of pure mathematics. The interests of present members of the department include number theory, algebraic and differential geometry and topology; preference may be given to persons whose interests lie in these or closely related areas.

Informal enquiries may be directed to Professor A. J. Scholl (telephone +44 91 74 2355, e-mail `a.j.scholl@durham.ac.uk`), or Dr. M. A. Armstrong (telephone +44 91 374 2352, e-mail `m.a.armstrong@durham.ac.uk`).

Further particulars may be obtained from the Director of Personnel, University of Durham, Old Shire Hall, Durham DH1 3HP, United Kingdom, to whom applications (five copies, including c.v. and the names of three referees) should be submitted by Friday, 10 June 1994, citing reference C013. Candidates outside the British Isles need submit one copy only.

SOUTH AFRICA

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG
Lecturer: Department of Mathematics

The Department of Mathematics wishes to make appointments to tenure track positions at lecturer level (assistant professor equivalent).

The Department has active research interests in algebra, analysis, mathematics education and number theory, but applications are encouraged from persons in any branch of mathematics.

The Department runs a major programme in pure mathematics and in mathematics for teaching (both to honors level) and has graduate students at the Master's and Doctoral levels. The Department is keen to play a role in science and technology development in South Africa by providing superior mathematics teacher-education and in-service training programmes for teachers, and by the development of the discipline and mathematics researchers for the region.

Candidates are expected to have a Ph.D. degree in mathematics or be completing a Ph.D. programme.

Further information is available from e-mail address: `076 SEARS@Witsvma.WITS.ac.za`.

Submit applications, including a detailed CV and the names and addresses of three referees to the Personnel Office (Academic), University of the Witwatersrand, Private Bag 3, Wits 2050, Johannesburg, South Africa, or fax (2711) 339-2223, by 30 June 1994. Quote ref: AMS 11106.

SWITZERLAND

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

The Swiss Federal Institute of Technology in Lausanne invites applications for a

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Female applicants are particularly welcome.

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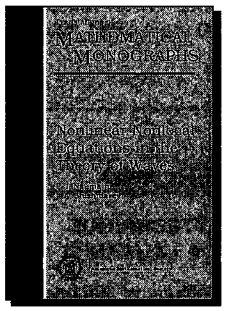

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Volume 133

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1991 *Mathematics Subject Classification*: 35, 45; 76
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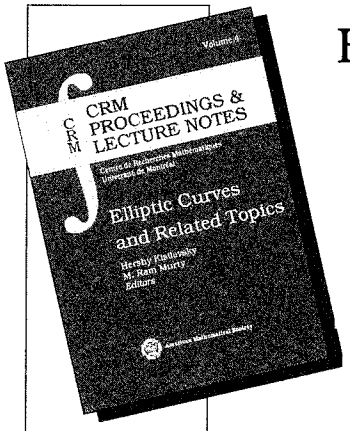

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Hershy Kisilevsky and M. Ram Murty, Editors
Volume 4

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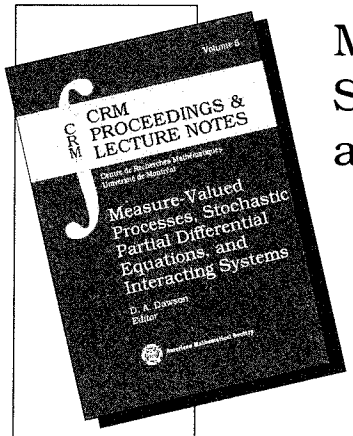

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❑ If workshop is fully subscribed, please place my name on the waiting list, pending a cancellation. I understand that my payment will not be processed until a place for me has been secured.

For office use only:

Codes:	Options:	Residence:
Dates:	Room Deposit	Amount Paid:

MAA Minicourse Advance Registration Form

Minneapolis, Minnesota

August 14–17, 1994

To register for MAA Minicourse(s), please complete THIS FORM or a PHOTOCOPY OF THIS FORM and return it with your payment to:

Minicourse Coordinator
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 advance registration: June 11, 1994. (After this date, potential participants are encouraged to call the MAA headquarters at 800-331-1622 for availability of Minicourses.)
- Deadline for cancellation in order to receive a 50% refund: August 11, 1994*.
- Each participant must fill out a separate Minicourse Advance Registration Form.
- Enrollment is limited to two Minicourses, subject to availability.
- Please complete the following and send both form and payment to the Minicourse Coordinator 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)

* ☐ I plan on registering in advance for the Minneapolis Mathfest 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 fully subscribed, a full refund of the Mathfest meetings advance registration fee will be made.

* If the box above is not checked off, the Mathfest advance registration fee will be processed and the 50% refund rule will apply. Your intention regarding the Mathfest registration should be made clear when cancelling a Minicourse registration. If no instruction is given, the Mathfest registration will also be cancelled. Advance Registration/Housing forms for the Mathfest should be mailed to the Mathematics Meetings Service Bureau in Providence.

See course descriptions, enrollment limits, and registration fees on the reverse.

Minicourse #1: *Building discrete and continuous ecological models using the SLAM simulation language*, James V. Caristi, Valparaiso University. Part A: Monday, 1:30 p.m.–3:30 p.m.; Part B: Tuesday, 4:00 p.m.–6:00 p.m. Enrollment limit: 30; registration fee: $65.

This minicourse will provide a crash course in using the simulation language SLAM for environmental modeling. SLAM supports discrete and/or continuous modeling, automatically and easily generates appropriate statistics, and can produce animations. We will develop a model of a leaf surface ecosystem involving competing microorganisms, arrivals and departures, temperature changes, moisture presence and absence, and acid rain. This is a basis for a project-oriented junior-senior level course for science majors. Prerequisite: proficiency with a mouse.

Minicourse #2: *Calculus from graphical, numerical and symbolic points of view*, Arnold M. Ostebee and Paul Zorn, St. Olaf College. Part A: Monday, 1:30 p.m.–3:30 p.m.; Part B: Tuesday, 4:00 p.m.–6:00 p.m. Enrollment limit: 50; registration fee: $45.

This minicourse introduces *Calculus from Graphical, Numerical and Symbolic Points of View*, a calculus text developed at St. Olaf College with support from the NSF and FIPSE. The text complements the standard symbolic/algebraic approach to the calculus with pervasive and systematic treatment of geometric and numerical points of view. Technology is used to foster and facilitate graphical and numerical thinking. This minicourse will include brief overviews of philosophy, pedagogy, and mathematical content; hands-on work on textbook problems; group discussion and critique; practical advice; and reports from experienced field-testers. Participants will be supplied copies of the text. Graphing calculators will be available on site; participants are encouraged to bring their own.

Minicourse #3: *Combinatorics via functional equations*, Donald R. Snow, Brigham Young University. Part A: Monday, 1:30 p.m.–3:30 p.m.; Part B: Tuesday, 4:00 p.m.–6:00 p.m. Enrollment limit: 60; registration fee: $45.

We will show that many of the ad hoc methods of combinatorics can be unified by a simple functional equations approach. This approach yields the sums of the powers of the integers (and many generalizations), combinations and permutations (with many types of repetitions), and other standard combinatorial functions, as well as many new results. The method uses the combinatorial description to find a functional equation and then finds the function from that. It gives a means of getting many of the identities, properties, and generating functions, and shows how the functions are related to each other. Spinoffs from the basic approach include the Bernoulli and Euler polynomials, orthogonal polynomials, and other special functions. An understanding of basic combinatorics, calculus, and power series is sufficient background for this minicourse. The small amount of material on functional equations needed will be developed in the course.

Minicourse #4: *Multivariable calculus using the Harvard Calculus Consortium materials*, Thomas W. Tucker, Colgate University. Part A: Monday, 3:45 p.m.–5:45 p.m.; Part B: Wednesday, 1:45 p.m–3:45 p.m. Enrollment limit: 50; registration fee: $45.

The NSF-supported Harvard Calculus Consortium has completed a textbook in single variable calculus and is working on materials for a multivariable course. These materials have been used at a number of institutions. The presenters will give the participants an overview of those materials and their implementation, as well as direct experience with selected portions of the course. Participants will have the opportunity to work in groups on exercises from the text and discuss the pedagogical implications. The presenters will be **Daniel Flath**, University of South Alabama, **Deborah Hughes Hallett**, Harvard University; **Patti Frazer Lock**, St. Lawrence University; **John Lucas**, University of Wisconsin-Oshkosh; and the organizer.

Minicourse #5: *Mathematical models of epidemics*, Sonja Sandberg, Framingham State College. Part A: Monday, 3:45 p.m.–5:45 p.m.; Part B: Wednesday, 1:45 p.m.–3:45 p.m. Enrollment limit: 80; registration fee: $45.

This minicourse will discuss the many ways that mathematics has been and can be used to describe the behavior of epidemics of infectious diseases. Examples of models appropriate for undergraduate mathematics courses, such as probability and statistics, differential equations, finite mathematics, and mathematical modeling will be presented. The history of quantitative descriptions of epidemic trends will be covered using malaria as an example. Focusing on AIDS, models for risk to an individual, population models for predicting future trends and the utility of mandatory premarital screening for the AIDS virus will be discussed. Homework will be assigned between the two sessions.

Minicourse #6: *Unifying themes for discrete mathematics*, Ralph P. Grimaldi, Rose-Hulman Institute of Technology. Part A: Monday, 3:45 p.m.–5:45 p.m.; Part B: Wednesday, 1:45 p.m.–3:45 p.m. Enrollment limit: 80; registration fee: $45.

As discrete mathematics courses impact the college curricula, some students express concern about the apparent fragmented nature of the concepts. To dispel this feeling of fragmentation, certain unifying themes are 1.) the function—with its role in enumeration, the analysis of algorithms, finite state machines, and the preservation of discrete structures; and 2.) enumeration—as it reinforces the study of partial orders, equivalence relations, graph theory, and summation formulas.

Minicourse #7: *Open problems in plane geometry*, William O. J. Moser, McGill University; **Janos Pach**, City College of New York and Mathematical Institute of the Hungarian Academy of Sciences. Part A: Tuesday, 1:00 p.m.–3:00 p.m.; Part B: Wednesday, 4:00 p.m.–6:00 p.m. Enrollment limit: 80; registration fee: $45.

Drawing figures (graphs) in the plane is one of the oldest human activities. Yet, conventional graph theory and geometry often break down at the simplest possible questions about graph drawings. The course will survey some classical questions of this kind in recreational geometry (e.g. Turan's brick factory problem and Conway's thrackle conjecture) some of which have important practical applications. We shall also suggest some promising new approaches to these problems (using elementary results from combinatorics and topology), but in all of the results discussed there will be plenty of room for improvement. The nonspecialist is just as likely to make progress in this field as the organizers! Participants can expect to leave with an understanding of many problems which they and their students can investigate in the future.

Minicourse #8: *The Math Modeling/PreCalculus Reform Project: using discrete mathematical models to motivate mathematics*, Sheldon P. Gordon, Suffolk Community College; **B. A. Fusaro**, Salisbury State University. Part A: Tuesday, 1:00 p.m.–3:00 p.m.; Part B: Wednesday, 4:00 p.m.–6:00 p.m. Enrollment limit: 40; registration fee: $45.

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

Advance Registration/Housing Form
Minneapolis Mathfest

August 15–17, 1994

Please complete this form and return to: Mathematics Meetings Service Bureau (MMSB)
P. O. Box 6887
Providence, Rhode Island 02940 U.S.A.
401-455-4143; 1-800-321-4267, Ext. 4143

DEADLINES

Ordinary Advance Registration (including tickets)	June 11, 1994	
Hotel/Residence Hall Reservations through MMSB	June 11, 1994	
Final Advance Registration (no housing or tickets)	July 14, 1994	
Hotel Changes/Cancellations through MMSB	July 5, 1994	
Residence Hall Changes/Cancellations through MMSB	August 8, 1994	
90% Refund on Residence Hall Package	August 8, 1994	(no refunds after this date)
50% Refund on Banquets & Tours*	August 1, 1994	(no refunds after this date)
50% Refund on Mathfest Advance Registration*	August 11, 1994	(no refunds after this date)

REGISTRATION FEES
Advance Registration by
July 14, 1994

MINNEAPOLIS MATHFEST		
	Member of AMS, CMS, MAA, ΠME	$ 125
*	Emeritus Member of AMS or MAA	35
*	Nonmember	194
*	Students:	
	High School	2
	Undergraduate	20
	Graduate	35
*	High School Teachers or Librarians	35
*	Third World Country Participants	35
*	Unemployed	35

(N.B.: A separate form appears in this issue for advance registration for MAA Minicourses)

* See the section on "How to Register in Advance".

ADVANCE REGISTRATION SECTION:

1) _____ Telephone _____
(Please print) Surname First Middle

2) _____ _____
(Mailing address) (e-mail address)

☐ **I do not wish my badge and program to be mailed; however, the mailing address for my acknowledgment is given above.**

3) Badge information: Affiliation _____ MR Classification # _____

Names for Guest Badges: _____

4) Member of AMS ☐ CMS ☐ MAA ☐ ΠME ☐ Nonmember ☐ Member of other organizations: AWM ☐ NAM ☐

5) Students: Grad ☐ Undergrad ☐ High School ☐ **6)** Emeritus ☐ Third World ☐ Unemployed ☐ Librarian ☐ HS Teacher ☐

7) Mathfest fee $_____ **8)** Hotel Deposit (if applicable) $_____ **9)** Dormitory Payment $_____

10) Subtotal of Payments for Social Events (see reverse) $_____ **11)** Total amount enclosed for 7 through 10 $_____

Method of Payment: ☐ Credit Card (Visa or MasterCard only) ☐ Purchase Order (original institutional PO attached)

☐ Check (payable to AMS). Canadian checks must be marked "U.S. Funds".

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If this is your credit card, please print your name as it appears on the credit card on the line below and sign your name.
If this is not your credit card, please print card holder's name as it appears on the credit card on the line below and have the card holder sign:

☐ I plan to attend the MAA Student Workshop on Wednesday, August 17, 1994.

See reverse for registration for social events and reservations for hotel and residence halls.

For office use only:

Codes:	Options:	Hotel:	Dorm:	Room type:
Dates:	Hotel Deposit	Total Amt. Paid:		
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