

NOTICES

OF THE

AMERICAN MATHEMATICAL SOCIETY

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Calendar of AMS Meetings and Conferences

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

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

insofar as is possible. Instructions for submission of abstracts can be found in the January 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
890	† March 18–19, 1994	Lexington, Kentucky	Expired	March
891	† March 25–26, 1994	Manhattan, Kansas	Expired	March
892	* April 8–10, 1994	Brooklyn, New York	January 28	April
893	* June 16–18, 1994	Eugene, Oregon	April 4	May–June
894	* August 15–17, 1994 (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 1	December
	March 4–5, 1995	Hartford, Connecticut		
	March 17–18, 1995	Orlando, Florida		
	March 24–25, 1995	Chicago, Illinois		
	November 3–4, 1995	Kent, Ohio		
	November 17–18, 1995	Greensboro, North Carolina		
	January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		
	March 22–23, 1996	Iowa City, Iowa		
	April 19–21, 1996	Baton Rouge, Louisiana		
	January 8–11, 1997 (103rd Annual Meeting)	San Diego, California		

* Please refer to page 41 for listing of Special Sessions.

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

Conferences

June 7–11, 1994: AMS Symposium in Research Mathematics on Quantization and Nonlinear Wave Equations, Massachusetts Institute of Technology, Cambridge, Massachusetts.

June 11–July 6, 1994: Joint Summer Research Conferences in the Mathematical Sciences, Mt. Holyoke College, South Hadley, Massachusetts

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

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

Deadlines

	March Issue	April Issue	May–June Issue
Classified Ads*	January 26, 1994	February 22, 1994	April 25, 1994
News Items	January 17, 1994	February 13, 1994	April 11, 1994
Meeting Announcements**	January 20, 1994	February 17, 1994	April 18, 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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ARTICLES

- 5 Cultural Aspects of Mathematics Education Reform** *Michael Fellows, Ann Hibner Koblitz, and Neal Koblitz*

How can we reform mathematics education so as to make the subject accessible to students with diverse cultural backgrounds? How do we promote depth of understanding instead of the gimmickry of our high-tech, instant-gratification culture? Based on the authors' work with young people of diverse cultural backgrounds, this article provides insights on these important issues.

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From the Executive Director . . .

ADDRESSING PUBLISHING ISSUES

In the March 1993 *Notices* this column discussed the publishing role of the AMS. There it was observed that most of the programs and services of the Society relate to publishing and the communication of mathematics. It was also pointed out that the Society is undertaking a major effort to broaden and enhance its role as a publisher, positioning itself to respond to change and to be the publisher of choice for mathematics.

The issues facing the Society as a publisher are quite challenging. Many of these issues face all publishers, but they take on a different twist when combined with the Society being a professional, membership organization. The mission and goals of the Society require the consent of the membership. For the Society to achieve the goals of its publication program, it is necessary for the membership of the Society to accept, in principle, the general philosophy of the publication program and support the various activities and services of this program. Therefore, it is important that the members of the AMS be informed of the issues related to the publication program and that there be a synergy between the volunteers and the staff who work in the Publication Division.

A way of interpreting the AMS publication goal is for the Society to become a discipline-based leader in information services. This philosophy has been embraced by the Society's governing bodies and in the Society's strategic planning. However, there is a need for broader communication of this philosophy to the membership, as well as a need to adjust current thinking and practice to make the AMS "publisher of choice for mathematics". In particular the AMS must advance electronic delivery of information; improve its book acquisition program; increase economies of production; and develop effective worldwide marketing, promotion, and distribution of its products and information. Under the general umbrella of this AMS philosophy are particular issues like:

- publication cost recovery and the use of publication income to support non-income-producing activities of the AMS,
- quality of production and the extent to which the AMS switches to author-prepared materials and away from fully in-house edited and typeset materials,
- ownership of materials and copyright,
- electronic preprint and reprint services, and
- proactive acquisitions and a broader list of AMS publication products and services.

There are other important issues of publication related to *Mathematical Reviews* and the Society's Russian translation program. This column addressed the publication of *Mathematical Reviews* in the November 1993 issue of the *Notices*. The Society is currently engaged in negotiations with the Russian Academy of Sciences for continuation of AMS rights to translate into English and publish Russian language mathematics journals.

In an effort to address these issues in publication and the delivery of information, a policy Committee on Publications has been established, and an individual is being sought to fill the newly created position of Publisher of the AMS. The policy Committee on Publications is the mechanism for volunteer guidance and formulation of policy to be considered by the governing bodies and is expected to take the long-range view and advise the Society on policy related to publication. The Publisher of the AMS is expected to bring vision and leadership to the Publication Division and will lead a division of nearly one hundred employees and will have responsibility for book and journal acquisition, publication production, electronic products and services, marketing, promotions and sales, and warehousing and distribution.

The new policy Committee on Publications will hold its first meeting at the Annual Joint Meetings in Cincinnati. It is expected that the publisher will join the staff of the Society about this same time.

William Jaco

Letters to the Editor

Biting the Bullet

Why on Earth did the Forum editor reprint Solomon A. Garfunkel's rambling editorial (*Notices*, July/August 1993)? Saunders MacLane provided an intelligent response to Garfunkel's gibberish concerning graduate studies. However, MacLane failed to expose the fanciful claims about the current revamping of the K-12 curriculum.

Garfunkel would have us believe that the current fads, which are being promoted under the NCTM "Standards", will finally "get it right". The rubbish that is being promoted under the guise of "implementing the Standards" is documented clearly in *The Mathematics Teacher*, and I urge all members of the AMS to read the deplorable articles that have been published since September 1992.

John Saxon has done an outstanding job at exposing the self-professed "mathematics educators" who are unable to teach arithmetic and algebra, much less the "real-world problem solving" that they claim to be teaching. On December 2, 1992, Saxon was featured on WTIC-AM Radio in Hartford, CT. He presented a very accurate analysis of the deplorable state of mathematics education in the United States and stated:

"The National Council of Teachers of Mathematics, unfortunately, is overrun by college professors of mathematics education. These people are people who couldn't cut it in math. So they ran down to the School of Education, took sixty hours of show-and-tell, and call themselves doctors. And all of a sudden they are experts in math education, and they control the National Council of Teachers of Mathematics. Now this is not all of them; this is not a broad-brushed treatment. But the ones who are joiners, who have big egos, they are the ones who control the philosophy of math education in America."

On February 7, 1993, Andy Rooney rendered a priceless service to mathematics. Before a large national audience, he exposed the junk books, the idiotic games, and the bogus methods that are being used to teach arithmetic in some elementary schools. Transcripts of this "60 Minutes" broadcast may be obtained from Burrelles Transcripts, Box 7, Livingston, NJ 07039.

It is absolutely appalling that the promoters of the "Standards" are receiving such extensive funding from the National Science Foundation (NSF). The NSF has awarded \$100 million to organizations in twenty-eight states. This money is being used in a massive propaganda campaign for "Statewide Systemic Initiative". If the so-called Connecticut Academy for Education is any indication, these funds are being shamelessly wasted.

Although more and more mathematicians are speaking up, the vast majority are ignoring the current scams in mathematics education. No mathematician can remain silent when so much flimflam is being promoted as "mathematics".

Domenico Rosa
Teikyo Post University
(Received September 21, 1993)

Moving the Joint Meetings from Denver

I am writing in response to the letter in the October 1993 *Notices* from Ken W. Smith decrying the decision by the Boards of the AMS and the MAA to relocate the 1995 joint meetings from Denver in response to the passage in Colorado of the antigay Amendment 2.

When I first heard of the decision, I was pleased that the boards of my professional organizations were addressing my concerns as an openly gay mathematician. When I read the resolutions themselves, I was especially proud to be a mathematician, a long-time member of both organizations, and a former MAA Section officer, because of the precision of the boards' rationale for the decision to relocate the meetings: that as a result of the passage of Amendment 2, not all members of the MAA and AMS would feel welcome in the convention city. It seemed to me that the boards were not

joining a boycott as a political statement, as Smith claims, but were acting in the best interests of the entire membership by avoiding a meeting place which had expressed hostility against a significant number of members, including officers.

I wish to respond to Smith's assertion that the AMS decision involves "enforcing political correctness". He offers no hint as to what he means by this oft-used phrase. But I have learned to be suspicious of arguments or conclusions decorated with this buzzword; such reasoning is often unsupported by evidence or logic. I'll just point out that within the lifetime of most AMS members it was politically acceptable, and sometimes required, at many American institutions of higher education to exclude persons of African heritage as students or faculty members, to limit the number of Jews by rigid quotas, to pay women far less than the salary earned by men in the same position, and to fire any gay men or lesbians unfortunate enough to be "found out". While the road to a more equitable society may not always be a smooth one, I'd prefer to strive for inclusion and fairness than to return to the "correct" behavior of the past.

Mr. Smith claims that Colorado's Amendment 2 involves prohibiting "a special status" for lesbians and gay men. The simple truth is that we are only interested in the *equal* status enjoyed by most Americans to work, to live, and to participate in society free of harassment.

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.

At present, because of long-standing prejudices against gay men and lesbians and a coordinated national campaign to deny us our rights, dignity, and even our safety, we do not enjoy such equality.

Amendment 2, if implemented, would provide the protection of the law to an employer, an apartment manager, or a business owner who fires someone from her or his job, evicts a person from a rental, or bars a person from a restaurant or store for the sole reason that the person is perceived to be lesbian or gay. In some jurisdictions, this sort of discrimination is specifically prohibited by statute or court rulings, so that victims may have a redress to the law. The proposed Amendment 2 to the Colorado State Constitution would forbid the state legislature, the governor, the courts, and every local government within the state to prohibit such discrimination. Amendment 2 can be viewed as the assertion of a triple negation: No law may say "no" to those who, because of prejudice, say "no" to gay men and lesbians

seeking employment, housing, or public accommodations.

An employer, landlord, or business who discriminates against African Americans or against women can be forced to answer to the law, but under Amendment 2, discriminators against lesbians and gay men would be protected from any legal sanction. *So it is not gays and lesbians, but those who are prejudiced against us, who are demanding "special rights" to act out their prejudice to the detriment of others.*

I commend the MAA and AMS for their principled response to the climate of intolerance in Colorado and urge the boards of the two organizations not to retreat from their position on meetings in that state. It should also be noted that opinions such as those expressed by Smith will be firmly and publicly challenged.

Donald Y. Goldberg
Occidental College

(Received October 27, 1993)

I am troubled by the AMS Denver decision. During my long-standing membership, I had always assumed that the AMS was there to look after only my mathematical interests. I never imagined that the AMS would someday aspire to form my conscience for me and take the liberty of representing me in purely political, social, or moral matters. The Denver action signals the emergence of a new dimension to AMS membership that goes beyond acceptability.

Instead of drifting out any further, I hope that the Society will adopt a policy of refraining from involvement in purely political, social, or moral issues. My intention is to not renew my membership unless and until such a course is affirmed.

J. R. Senft
University of Wisconsin
(Received October 27, 1993)

Mathematical World • Volume 3

Mathematics and Sports

L. E. Sadovskii and A. L. Sadovskii

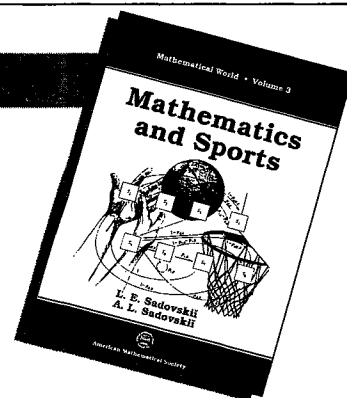
This unique book presents simple mathematical models of various aspects of sports, with applications to sports training and competitions. Requiring only a background in precalculus, it would be suitable as a textbook for courses in mathematical modeling and operations research at the high school or college level. Coaches and those who participate in sports will find it interesting as well. The lively writing style and wide range of topics make this book especially appealing.

1991 *Mathematics Subject Classification*: 92; 90

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Cultural Aspects of Mathematics Education Reform

*Michael Fellows, Ann Hibner Koblitz,
and Neal Koblitz*

Michael Fellows is in the Department of Computer Science at the University of Victoria in Canada; Ann Hibner Koblitz is in the Department of History at Hartwick College in Oneonta, New York; and Neal Koblitz is in the Department of Mathematics at the University of Washington, Seattle.

In discussions of reform of precollege mathematics education, cultural aspects are often overlooked. Here we shall use the word *culture* in several senses: the culture of different countries and ethnic communities, American popular culture, patriarchal culture. Our purpose is to stimulate consideration of such questions as:

- To what extent do the currently proposed ideas for math education reform carry across cultural boundaries (to other countries and to minority communities in the U.S.)?
- How might girls' study of science and math be affected by education reform? How does the reform of math education relate to current discussions of gender and science?
- What distortions of the education reform process can occur as a result of the peculiarities of American culture?

Mathematics is arguably the most international and intercultural of all academic professions. Just as the basic ideas and techniques of the mathematical sciences can develop in any part of the world, so also one would expect that the *best* methods and materials for teaching math would be ones that can be readily adapted for use in any cultural context.

Lately, more mathematicians than ever before have become interested in precollege education and have started visiting classrooms in an attempt to improve children's impressions of mathematics. One hopes that this activity will eventually produce far-reaching benefits. However, these contacts with the school system have often been limited to the relatively privileged schools which the mathematicians' own children attend or else the advanced tracks and the special programs for selected youngsters.

To broaden one's perspective, it is worthwhile to try out one's ideas for teaching math to children in nonprivileged classrooms as well—for example, in the nonadvanced tracks of urban public schools. This gives a fairer test of how well the ideas work, and in some ways it can be especially rewarding. These children, after all, are not nearly so accustomed to enrichment presentations as are the children in the upper tracks and the wealthier schools.

Our Project

In order to gain a broad experience in presenting mathematical ideas to children, the authors have worked with groups of children in a variety of settings. These have included: second to seventh graders from middle-class families in Victoria, Canada; a diverse group of children and parents in a city park in Victoria; sixth grade classes in Seattle which are 70%–80% Black and Hispanic; two seventh grade classes in rural Washington state; third and fifth grade classes in Lima, Peru; an informal group of 7- to 12-year-olds in Cuzco, Peru; sixth and seventh graders in two different schools (one private, one public) in San Salvador, El Salvador; a group of rural schoolgirls brought together in the provincial city of San Vicente, El Salvador; a group of 7- to 13-year-olds in a low-income *barrio* in San Juan, Puerto Rico; and a class of thirty seventh graders in a poor neighborhood of Harare, Zimbabwe.

The topics we have presented are radically different from the usual type of material in school curricula. They have included:

1. Finding a minimum weight spanning tree for a graph. For example, at minimum cost you want to pave enough streets of Muddy Town so that one can find a paved route from any vertex (street intersection) to any other vertex.
2. Finding a minimum dominating set of vertices in a graph. Stories told to motivate this topic concern the problem of facilities location. Two examples will be mentioned later. Children usually get an intuitive feeling that this problem is harder than the spanning tree problem (in fact, it is NP-complete).
3. Constructing a graph in which we know a "hidden" perfect code that would be very hard for anyone else to find. Such a construction can be used for a type of public key cryptography that is accessible to children.
4. Using Boolean circuits to construct a "long distance coin flip" protocol.
5. Breaking a Caesar or Vigenère encryption by analyzing frequency of letters.
6. Playing a card game based on generating certain classes of prime numbers. It is an unsolved problem of number theory whether or not the card game can go on indefinitely.

7. Using the different types of averages (mean, median, mode). When are they nearly the same, and when do they give very different impressions of the data?

After posing a problem such as Muddy Town, we typically find that the classroom explodes with activity, and there is a tremendous range of response. The children's immediate objective is to find the best possible solution. After a child has a solution, her or his name is posted on the blackboard along with the cost of the solution. Students are asked to describe their strategies and ideas. Some are able to discover a systematic procedure (perhaps a variant of Kruskal's algorithm) and can offer arguments supporting it. One fascinating aspect of the classroom experience has been the reports of the teachers that their expectations concerning student performance are often turned topsy-turvy; the children who do well on these problems are not always those who have done well at the usual arithmetic drill.

There is something in these problems for the whole range of students, from the slowest to the brightest. Some students only manage to understand the mechanics of finding a correct solution. Others make progress toward an algorithm for obtaining an optimal solution. The most inventive students want to design their own Muddy Towns and to ask further questions, for example: How can one determine if a given solution can be improved upon? What is the minimum *number* of streets paved in an optimal solution? How many different optimal solutions can there be?

These topics are fun and exciting for the students. Once, after we presented some of the topics to a 5th grade class in Peru, the students insisted on continuing through the recess period despite the appeals of the school's headmaster telling them it was time to go. The teacher observers later commented to us that they were astounded to see youngsters refusing to leave math class to go to recess!

Beyond their entertainment and motivational value, the topics listed above provide an excellent vehicle for implementing the NCTM standards, which place an emphasis on *problem-solving*, *communication of mathematical ideas*, and *real applications*. Because of their intrinsic interest, problems such as these tend to elicit sustained periods of concentration. Besides providing opportunities for children to practice "the basics", they lead naturally to discussions of sophisticated and challenging ideas of contemporary mathematics and computer science (complexity of algorithms, one-way functions, interactive protocols, prime number generation, interpretation of statistics). They convey some of the spirit and excitement of mathematics as it is known by those who *do* mathematical science.

The Influence of U.S. Culture

The educational reform movement has taken a strong stance against the traditional characterizations of math as difficult, dreary, and accessible only to a small number of people. Slogans such as "math for everyone", "math for girls", "math for the family", and "math is fun", along with new concepts of cooperative learning, integrated (i.e., interdisciplinary)

teaching, and alternative assessment methods, are beginning to change the face of math education in the U.S.

This change is welcome and overdue. However, some of these efforts have gone astray because of certain political pressures and the peculiarities of American popular culture. In the first place, in order to make a good impression on the funding agencies, coordinators of pilot projects must demonstrate rapid success. This creates pressure to set one's sights very low and present material that the students will almost certainly find easy. As a result, many of the units that have been developed are conceptually trivial and are not challenging for the target grade level. For instance, in the otherwise excellent booklet *Assessment Alternatives in Mathematics*, we found that most of the concrete examples have too little mathematical content for the intended age group. Interestingly, the booklet's only illustrative problems that contain challenging mathematics were taken from the Shell Centre for Mathematical Education in Great Britain, where educational standards have not yet fallen to American levels.

The anti-intellectual nature of U.S. popular culture is well known. Children are accustomed to rapid-fire visual imagery, passive entertainment, and instant gratification. The schools then have an uphill struggle if they want to teach intellectual discipline, delayed gratification, problem-solving techniques to handle difficult challenges, and the non-oral forms of communication (reading and writing). Unfortunately, there is no easy way out of this dilemma. But it would be a tragic mistake to throw in the towel, stripping science and math of their content in order to make education easy and entertaining.

There is a real danger in the level of hype in the education reform movement. An extreme example of this tendency is the public television program "Square One". Listening to the songs about math, seeing the animation and special effects, and watching the guessing games, one might not notice that the program has virtually no mathematical content. Moreover, the program gives a misleading impression of what mathematics is and how it is used.

Computermania

American youngsters—and, in fact, most teachers and education reformers as well—have grown up in a culture that emphasizes gimmickry, easy technological fixes, and 15-second sound bites on TV. In addition, the computer industry—one of the few industries in which the U.S. is the undisputed leader—has a vested interest in promoting the adoption of technology in the schoolroom.

Amidst all the hype about computers in the classroom, few have stopped to consider certain basic questions. Do the results justify the vast amounts of resources—money, time, and human energy—that have been invested? Are other needs (school libraries, released time for teachers, low-tech forms of math enrichment) being neglected? Students have a common perception of mathematics as something formalistic and mechanical. Won't computers make matters worse?

Of course, it is reasonable to think that there might be some appropriate uses for computers—just as earlier for television

and movies—in the classroom. But from our observations it seems that most of the time computers serve as little more than an expensive distraction. They foster a Golly-Gee-Whiz attitude that sees science and math as a magical black box, rather than as an area of critical thinking. That is, fetishizing computers serves to reinforce the fascination with gadgetry (as opposed to intellect) that is endemic in American popular culture.

From what we have seen, most educational software is based on immediate gratification and very little creativity. Generally, the pupil is programmed to follow a path already laid out in detail by others. The child is physically active but intellectually passive. The computer controls the student, rather than vice-versa. It seems to us that *what children need in order to become mathematically literate citizens in the computer age is not early exposure to manipulating a keyboard but, rather, wide-ranging experience working in a creative and exciting way with algorithms, problem-solving techniques, and logical modes of thought.*

Finally, the notion that computers must be at the heart of educational reform necessarily implies that most people in the world are excluded from the reform. The vast majority of schools do not have anything like the resources that would be needed to incorporate computers into classroom learning.

Cultural Appropriateness

When designing problems that relate to real life, it is easy, despite our good intentions, to be insensitive to cultural differences. For example, the first author initially constructed a story about “Tourist Town” in order to present the minimum dominating set problem of graph theory to children in the U.S. and Canada. The merchants of Tourist Town (of which a map has been passed out to the class) are preparing for the summer season. They decide to construct ice cream stands on some of the street corners. What is the minimum number of ice cream stands they’ll have to build so that anyone standing at a street corner without an ice cream stand will have to walk only one block to find one?

But when the three of us tried this in Peru, we quickly realized that this story made little sense to the children. The reason is that, in the first place, ice cream sellers use movable carts, not fixed stands. Moreover, in any country with large unemployment, where much of the population depends on the so-called “informal economy” for their livelihood, there is always an overabundance of people available to sell ice cream to tourists. The children saw no purpose in trying to minimize the number of ice cream vendors.

So we changed the setting for the dominating set problem, presenting it by means of a story about minimizing the number of wells in order to achieve an efficient water supply for a village or *barrio*. In most Third World contexts such a story is more appropriate than the one about ice cream stands, and it has led to a more enthusiastic response both by the children and the teacher observers.

Similarly, when working with children in the industrialized countries of the northern latitudes, one might want to replace the street-paving story for minimum weight spanning trees

(Muddy Town) by a story about deciding which streets to plow after a snowstorm. The first author has found that Canadian youngsters relate especially well to the Snowy Town story.

In our zeal to replace dreary traditional math with entertaining practical examples, we can easily let our own background and biases affect the problems selected. 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. For example, the Interactive Mathematics Project (IMP)—supported by the NSF and a consortium of Bay Area educational institutions—has developed fifteen units for eventual use in California high schools. Of these units, four appear to be flawed because of cultural biases:

1. *Pennant Fever*. “The Good Guys have a three-game lead over the Bad Guys for the baseball pennant The central problem of the unit is to find the probability that the Good Guys will win the pennant.”

This baseball setting is designed to motivate the study of probabilities. But clearly boys are more likely than girls to be inspired by this example.

2. *The Overland Trail*. “This unit looks at the western migration of the 1840s and 1850s in terms of the many linear relationships involved. These relationships grow out of the study of planning what to take on the 2400-mile trek, estimating the cost of the move, studying rates of consumption and of travel, and estimating the time to reach the final goal.”

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. *The Dawning of the Age of Aquarius*. “This unit uses a question based on astronomy as a way of having students feel a need for using scientific notation The sixties song ‘Aquarius’ talks about ‘the Age of Aquarius’ as an era of harmony and liberation, and students are asked to consider the question of when, astronomically speaking, this age should actually begin.”

The song “Aquarius” might motivate mathematics for the offspring of a certain number of Californians of the generation of the 1960s. But this would include very few children from the large Black, Hispanic, or Asian communities of the state. Nor would most rural and blue-collar white children feel included.

4. *Leave Room for Me!* “This unit opens with a table of world population data over the last thousand years and asks the following rather facetious question: ‘If population growth continues to follow this pattern, how long will it be until people are squashed up against each other?’ . . . [students] discover that exponential functions have the special property that their derivative is proportional to the value of the function and see that . . . an exponential function is a reasonable choice to use to approximate their population data.”

Of course, the exponential model is extremely dubious for human populations. But more importantly, the

point of view of this unit 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. At its worst, the alarmism implicit in the cry "Leave room for me!" leads to racist paranoia. In any case, none of the IMP units provide alternative, less elitist viewpoints—for example, that the more fundamental causes of the world's problems are the extreme inequities in distribution of wealth and in consumption.

We wish to reiterate that the Interactive Math Project may very well be making important positive contributions to the curriculum. Cultural insensitivity can be a problem even among the most experienced and well-intentioned people.

Gender Questions

Given the different socialization of girls and boys in the U.S., it seems clear why traditional methods of teaching mathematics would yield better results with boys than with girls. When taught in a formalistic, mechanical manner—as something boring and lifeless—math can be perceived as akin to a fraternity hazing. That is, the student might view math class as an unpleasant and pointless ritual that one must go through in order to join an elite of successful people. Under those circumstances it is outside pressure and societal expectations that determine who is likely to do well.

Boys might be more willing to put up with the torment of poorly taught math courses because they have confidence that eventually they will be rewarded by society. Girls, on the other hand, tend to have fewer role models, fewer external incentives to do well at math, and more peer pressure not to do well. For instance, it is more common for parents to tell their sons that they must get good grades in math so as to become engineers like their fathers than to tell their daughters that they must get good grades in math so as to become engineers like their mothers.

Because of the different pressures on girls in our society, they are unlikely to become interested in mathematics unless it is intrinsically motivated—in other words, unless it is taught in an absorbing, lively, thought-provoking manner. While obviously all students can benefit from reform of mathematics education, there can be particular gains for girls.

At the same time, there are also special pitfalls against which reformers, we believe, have not been sufficiently vigilant. One of these pitfalls relates to the use of computers and the notions of so-called "soft" and "hard" mastery, made popular by Sherry Turkle in her book *The Second Self*.

For Turkle, "hard mastery is the imposition of will over the machine through the implementation of a plan . . . the hard masters tend to see the world as something to be brought under control." Soft mastery, on the other hand, is more interactive—"the soft masters are more likely to see the world as something they need to accommodate to, something beyond their direct control." Though Turkle gives examples of soft masters of both sexes, she says, "Girls tend to be soft masters, while the hard masters are overwhelmingly male."

Turkle here is propagating a fundamental misconception of mathematical and scientific thought processes in that she divorces the artistic and creative elements from the rigor and intellectual discipline. What Turkle dichotomizes as "hard" versus "soft" mastery are actually two necessary components of innovative thinking in science. The attempt to categorize people as being one or the other therefore misses a crucial point and reinforces certain sexist stereotypes and notions of gender polarity which are already far too powerful in our culture.

Turkle herself inserts some caveats in her generalizations. But what has usually been picked up by the media is the rather simplistic idea that girls cannot be attracted to the computer—or to anything math-related—unless it can be portrayed as artistic, relational, and "soft", and unless it has been purged of everything complex, systematic, and mathematically challenging. Unfortunately, too often the result is pedagogical material that is scientifically and mathematically trivial.

One of the most common manifestations of sexism and racism in the classroom is a refusal to intellectually challenge girls and members of minority groups. They are condescended to and patronized, and do not receive adequate exposure to the more rigorous and thought-provoking aspects of mathematics. Their understanding thus rarely attains the level of the systematic and the structural; they seldom arrive at the stage where they can see much point in doing mathematics.

In our experience, though, once young women have become intrigued by a problem, they relate well to all aspects of mathematical creativity—the formal and systematic as well as the intuitive. For example, as often as not, the optimal solutions to the discrete math problems we have presented—and rigorous arguments to support these solutions—are offered first by girls. This is in spite of the fact that the boys tend to push themselves forward more and tend to receive more encouragement for this aggressive behavior from their teachers (and often from the girls themselves).

Conclusion

In the course of our travels we have been struck by the extent to which the crisis in math education is international. Educational reform is a topic that is likely to provoke intense interest and animated debate in a mathematical gathering almost anywhere in the world. Invariably, in our meetings with math educators we are asked to share any materials that we have. Consequently, when we in the U.S. develop new curricular material, we should adopt a multicultural perspective and be sensitive to the diversity of people who may want to use it.

We need to resist the pressures of fads and hype and be aware of the inevitable tension that exists between American popular culture and the study of mathematics. We should not let those who have money—the foundations and government agencies, the computer companies and textbook publishers—dictate the agenda for reform. The math education reform movement should be open to input from many sources: educators who do not have foundation support as well as those

who do, laypeople as well as professionals, people from the impoverished schools and universities of the Third World as well as those from the centers of prestige and power in the U.S.

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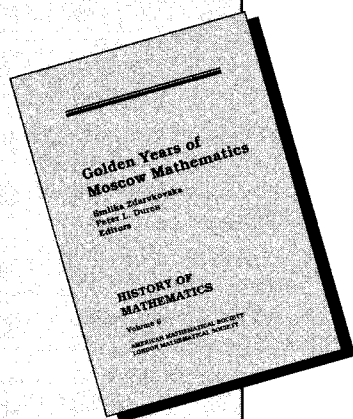
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HISTORY OF MATHEMATICS

Golden Years of Moscow Mathematics

Smilka Zdravkovska and Peter L. Duren, Editors
Volume 6



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The Immortality of Proof

Steven G. Krantz

Washington University

This is a response to the cover story, "The Death of Proof," in the October 1993 issue of *Scientific American*. More generally, it is a commentary on the circle of ideas touched on in that article.

The article suggests that the fashion of mathematicians stating theorems and proving them is passé. Various reasons have been offered for this transition: that mathematics has become so complicated that most mathematicians cannot understand other mathematicians' proofs; moreover, the proofs are too long and complicated. Wiles's proof of Fermat's Last Theorem is 200 pages; it would be 1000 pages if all the details were provided. W. Y. Hsiang's resolution of Kepler's sphere-packing problem is still, after three or more years, in doubt. (In fact some experts have told me recently that they believe Hsiang's proof to be incorrect—but at least these experts understood the material that Hsiang offers as a proof!) This time delay is also offered as tribute to the idea that things are so complicated that we don't know what we are doing.

Some have suggested that the logical foundations of mathematics are little more than a polite agreement. They are riddled with inconsistencies that are virtually insoluble. This is offered, it seems, as evidence that those dinosaurs (such as myself) who cling to mathematical tradition are being unreasonably stodgy. After all, what is the sense of defending something that isn't quite right? Why not allow that there are other ways to do mathematics besides proving theorems? Can we not establish truths by analyzing computer graphics

or showing, à la Babai, that certain statements are "probably true"?

In the uproar that has followed hard upon the *Scientific American* article, it has been pretty well established that the theme of the article is a figment of the author's imagination. Nobody can find a mathematician who is willing to state in public that the proof is dead (anyone care to volunteer?). Evidently John Horgan (the author) only partially understood his interviews with a number of mathematicians. He fashioned a chimeral picture of what he thought he heard, weaving pieces of various interviews into a bizarre tapestry with no basis in reality. No matter what the genesis of the article that actually appeared in print, I think that the ideas presented there are dangerous—dangerous to you, to me, and to our profession and our subject. A number of good people have stood up and formulated their own answers to the article. This is mine.

Here is the truth: Andrew Wiles's proof of the Fermat theorem is not an "anachronism", as the article asserts. It is a triumph of the human intellect. Understanding it is not beyond our collective ken, as the article suggests. Gauss claimed to have been the first to discover non-Euclidean geometry. He did not publish because he did not think that anyone would understand what he was talking about. By contrast, students today learn about non-Euclidean geometry in high school. New ideas take time to become part of the infrastructure.

All over the world, in hundreds of seminars, people will go through Wiles's proof of Fermat's Last Theorem. It will finally be validated, or it will not. A good role model here is Louis de Branges's book on Hilbert spaces of holomorphic functions, which (purportedly) gave a proof of the Bieberbach conjecture. After a lot of thought and analysis by many mathematicians, there is now a two-page proof by Lenard Weinstein—based on de Branges's ideas, to be sure, but involving little more than calculus. Lennart Carleson's proof of the Lusin conjecture was also quite obscure. But, after a time, a great deal of study by many mathematicians, and an independent proof by Charles Fefferman, we now know that it is correct. That proofs evolve and are validated in this way is a tribute to the robustness of mathematics and to the process of mathematics. It is quite likely, if Wiles's proof is right, that simplified proofs of Fermat's theorem will evolve.

It is worth developing this last idea. Mathematics is not simply an endeavor carried out by certain individuals or small

groups. It is in fact a process. Certain “point men” often come up with the final step—the proof—of a great theorem, but a close analysis shows the workings of the infrastructure to generate many of the ideas in the proof and to validate it afterward. This is part of what is so beautiful about the way that mathematics works—one person puts the final words on paper, but the entire community carries the ball (and makes sure that the ball has air in it).

It is true that Hsiang’s proof is still in doubt. This is because very few people have read it or thought hard about it. In the three hundred-odd years since the problem was formulated, mathematics has evolved and dispersed in many directions. Until recently sphere packing has not been considered to be a central issue. (The recent book of Conway and Sloane will probably change that.) But the purported solution of the Kepler problem is just not the sort of problem—today—that will make mathematicians drop what they are doing to read the 150-page solution. Eventually we will know whether Hsiang is right, but most of us have had our attention diverted elsewhere.

Finally, about the foundations of mathematics: everyone knows about Russell’s paradox and the problems with constructing the integers. But logicians have determined how to deal with these things. Morris Kline to the contrary, mathematics is not built on a foundation of sand. There is no area of human inquiry that is more robust or more solid than mathematics. One of the reasons that mathematics is of lasting value is that it is logically consistent. New generations do not shoot down old mathematics in favor of the new. For good mathematicians to claim otherwise is counterproductive and irresponsible.

Another point of view worth considering is this: while the foundations of mathematics are interesting and important, they have little to do with the everyday workings of mathematics. Waving Gödel’s incompleteness theorem and Russell’s paradox in my face is not going to stop me from thinking about complex analysis, and it should not stop you from thinking about geometric topology or whatever your chosen field may be. The Hilbert/Bourbaki view of mathematics as growing logically from solid foundations is a bit like Newton’s view of physics: philosophically sound, but not the whole picture.

One of the themes of the *Scientific American* article is that proofs will soon be replaced by computer experimentation. Invoking recent ideas of Babai, it is suggested that computers can suggest to us that assertions are “probably true”. Computer graphics can show us things that we cannot see unaided. It is important to sort out here the differences among computer simulation, graphical experimentation, numerical experimentation, “computer proof” (whatever that is), and the use of computers to graphically illustrate the meaning of a theorem that has already been proved by classical means (such as the computer graphics movie *Not Knot*). Let me point out that computer experiments could never have informed Yau’s proof of the Calabi conjecture, nor the Calderón-Zygmund theorem about singular integrals, nor the work of Nirenberg/Treves and Beals/Fefferman on local solvability of PDE’s, nor the work of Kohn on the inhomogeneous Cauchy-Riemann equations,

nor Egorov’s work on canonical transformations. Computers were used in one of the technical steps of de Branges’s proof of the Bieberbach conjecture, but it is ludicrous to think of de Branges using the computer to generate power series of various Schlicht functions and staring at the coefficients to get ideas.

It is my understanding that the movie *Not Knot* has been used to great effect in getting high school students excited about mathematics. Many of those students have gone on to become math majors and then on to careers in mathematics. Any device that will generate talented American mathematicians, that will draw students back to math from business school, law school, computer science, and so forth is a godsend. But let us not, in our enthusiasm (with a pied piper like John Horgan), trick ourselves into thinking that the movie is a “computer proof” of anything. The movie *Not Knot* is a device for popularizing mathematics, something that needs to be done a lot more in this country. Most Americans are not even aware that there is a profession called “mathematician”. There is nobody to blame for this but ourselves.

In many respects this is a golden age for mathematics—and I mean classical, rigorous mathematics done in the traditional way. There are fantastic collaborations taking place between geometers and PDE people, between geometers and physicists, between geometers and analysts (to name just a few). The rate at which enormous breakthroughs are being made is incredible. Yet the mathematics that often grabs the headlines is some new form of computer graphics. This is understandable, for the public is much more ready to consume computer graphics than pseudodifferential operators.

Yet this puts the onus on us, the dinosaurs, to figure out how to get the public to appreciate what we are up to. Don’t forget that “the public” includes (1) potential graduate students, (2) senators and congressmen, and (3) the American voters. Also, program officers at the National Science Foundation (NSF) and other agencies read *Scientific American*. I wouldn’t doubt that their ideas about funding are influenced in part by what they read. If you work in a field, such as I do, that does not lend itself to computer graphics in any obvious way, then you should think about how to let your graduate students, your undergraduates, and (if possible) a broader base of people know what it is that you do and why it is worthwhile.

Doing mathematics is hard. Programming computers (at least at the level of creating videos of a theorem that some smart guy proved ten years ago) is relatively easy. While the latter can be important in popularizing and communicating our subject, I hope that we will not commit the same error as John Horgan and think that it is the same as *doing* mathematics. Looking at this in a different way, let me point out that doing graphic or numerical experimentation to generate ideas for a proof or to provide enough examples to give one the courage to go on is a valuable exercise. But it is not a goal in itself. It has no intrinsic value.

At the risk of beating a dead horse, let me observe that dynamical systems is a vital, well-rooted, vigorous area of modern mathematics. Drawing pictures of fractals, giving them names like “XP-43”, and printing them on picture

postcards that sell for \$1 a throw is not.

I was quoted in the *Scientific American* article to the effect that mathematicians are a bunch of “spineless slob”, unwilling to stand up and defend their subject. I regret this. I don’t recall making the statement; in fact it is not expressed in my usual argot. But it is up to us to define what our subject is and to defend it. If I had in fact made this statement, I would now have to withdraw it; I have been pleased to see the great numbers of mathematicians responding to Horgan in defense of what we do. I’d like to think of Horgan’s misquotation of me as a catalyst. Now let’s consider it used up and dead.

As the *Scientific American* article reported, high school teachers in Berkeley are now minimizing proofs in Euclidean geometry. One argument in support of this change is that a computer can quickly test 5000 cases of an assertion so that proofs are no longer necessary. Well meaning though these changes may be (the teachers may have in mind students from disadvantaged backgrounds or students who have watched too much television and are permanently in the passive mode), they fly in the face of fundamental mathematical values. The article itself claims that students no longer appreciate the value of proofs. So we have to find another way to teach them.

Students do not appreciate the value of reading unless they are taught. They do not appreciate the value of good music unless they are taught. (Is anyone advocating that we replace Beethoven’s Fifth Symphony by “da da da dum” and a video because it is too complicated?) And students will not appreciate the value and importance of mathematical thinking unless they are taught. It is our job to teach them, *not* to bend like reeds in the breeze. We should work with high school teachers to inculcate strong intellectual values in students, not to pander to their uninformed whimsy. I fear that the low salaries and lack of respect that high school teachers find to be their lot these days has given us a group of not very well trained high school teachers who are uncomfortable with proofs in Euclidean geometry. I recently asked a group of high school teachers in my city how they treat Euclidean geometry in school, and they didn’t know what Euclidean geometry was.

Another interesting aspect of life is that bureaucracies like hardware. When parents come to a university to get an impression of whether they should send little Sally there for her four formative years, the leading lights in the administration do not trot out their rather shabby-looking Nobel Laureates and Fields Medalists. Instead, they show off their genetic engineering labs and supercomputer centers. Likewise, taxpayers understand money that is spent to buy PCs and software. They do not understand money that is spent to increase teachers’ salaries so that we can get better teachers. Remember that we, the mathematicians in this country, are the caretakers of mathematical knowledge. It’s not the books, and it’s not the software; it’s us. It is up to us to define what mathematics is and to defend it. Now that NSF grants are going the way of the dodo, maybe we will have more time to do so.

I am happy that the work of Jean Taylor and of David Hoffman and his group were given prominent mention in the article in *Scientific American*. These scientists are working in

areas that can be informed by computer experiment (and also more visceral experiment—like dipping wire frames into soap solution). After they have done their experimentation, they then prove theorems. That way we know what is true. One of the triumphs of mathematics is that it transcends anecdotal information. The traditional definition of *theorem* is something like this: “the establishing of immutable quantitative or geometric truths by means of tried and exact reasoning”. To replace this definition with “the offering of uninformed speculation after staring at computer graphics” would be both wrong headed and tragic. Tragic because it abrogates, without careful thought, everything that we’ve learned in the last 3000 years. Wrong headed because the value of traditional mathematics is well established while the value of the new stuff is not.

To use the work of Hoffman and Taylor to justify discarding proofs and replacing them with “probable proofs” and “graphical analysis” is like using the work of John Stuart Mill to justify anarchy. William Jennings Bryan was a great public speaker and so was Adolph Hitler. Therefore what? Again, the *Scientific American* article is using classical propagandistic techniques, such as confusing the converse with the contrapositive, to support the case that mathematical proof is being replaced with computer experiment. We all know that this is fallacious but will the readership of *Scientific American* know this?

I have used computer algebra to inform calculations that had become too complicated to handle by hand. I imagine that someday I will use graphics to help me to see something that I cannot see in my mind or with a pencil and paper. I advocate strongly that other traditionally trained mathematicians consider becoming conversant with these new tools. But the tools are not an end in themselves. Drawing a picture of a simply connected domain in the plane is not the same as proving the Riemann mapping theorem (RMT), even if it is a computer that drew the picture. I’ve been thinking about the RMT for over twenty years, and I’ve never used any kind of picture to aid my thoughts. Thurston, Rodin, and Sullivan have given us interesting new ways to think about the RMT that are very geometrical and do lend themselves to nice computer pictures. But the pictures do not prove anything.

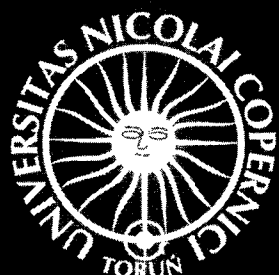
And let us not misunderstand each other: pictures are valuable. They are particularly valuable in communicating mathematical ideas, but they are also valuable when you are in private, trying to solve a problem. The availability of wonderful graphics software now makes drawing complex pictures easy and offers us an exciting new tool. But if Gauss, smart as he was, had had a computer available to him, it would not have enabled him to prove the Riemann mapping theorem years before Riemann.

I hope that other mathematicians will discuss these matters and perhaps disagree strongly with what I say. The wolves are in our midst, and it is time for us to decide what we believe and what we value. One of the upshots of the discussions that have taken place since the *Scientific American* article appeared is that it seems unlikely that many of the wolves are mathematicians. But the wolves are still a danger. They have

influence in the media and influence with funding agencies. We must be aware of the dangers that lie outside our cloister.

It may or may not be true that in ten or fifteen years we

will have abandoned proofs and will be letting computers tell us what is probably true. But in ten or fifteen years it will be too late to decide what we want. We have to decide today.



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Computers and Mathematics

Edited by Keith Devlin

This month's column

Three software reviews make up the first column of 1994. First, Larry Lambe looks at *AXIOM*. Then, Suzanne Molnar reports her experiences with the Student Edition of *Object Logo*. Finally, Jim Northrup reviews *Fields&Operators*.

All three reviewers have contributed to the column in the past, and it is good to see them back. But I am always on the lookout for new reviewers. In particular, my list of volunteers willing to review Macintosh software is starting to run down. If you use a Macintosh and would like to make your own contribution to the column, please send me a message at the address below (e-mail or snail-mail), mentioning any particular preferences as to the kind of software you would like to review.

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Reviews of Mathematical Software

***AXIOM* System**

Reviewed by Larry Lambe*

A little more than four years ago, I wrote about "*Scratchpad* II as a tool for mathematical research" in this column [L1]. *Scratchpad* has grown into what is now called the *AXIOM* system, and there is a lot to say about this evolution. I think of it more as a maturation, although neither term is quite right for what has happened. In fact, as you will see, my original remarks about the mathematical nature of *Scratchpad* can be

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taken verbatim in connection with *AXIOM*. Some of the new things are a user interface that rivals anything that can be found in the market these days, a flexible graphics interface that can provide both insight and enjoyment, and a new book [JS] that covers the system quite nicely.

Specifically, *AXIOM* is a "mathematically object-oriented" environment consisting of five major components and a sixth that is under development and soon to be released. They are

1. an interactive computational environment,
2. a "hypertext" interactive documentation system that is user programmable,
3. a graphics package that manipulates and displays objects in two and three dimensions,
4. an object-oriented language,
5. an extensive mathematical library compiled into machine code for efficiency with complete access to the source code for all users, and
6. a link to external libraries written in other languages.

The thrust of the 1989 article was the object-oriented nature of the system and, in particular, its inclination towards mathematics. This is an important and distinguishing feature of *AXIOM*. Issues such as "code reusability" have been around in computer science for some thirty years. The notion of parameterized types in the formal theory of computer languages goes back quite a way as well. These days more and more of such concepts are finding their way into other areas of science that use computer aids.

We are still in a time when there are different terminologies in use for exactly the same concepts in different object-oriented languages. Because of this, it will be useful to set up a dictionary, through the use of analogy, to define some terms.

I'm pretty sure that you've all heard phrases like "object-oriented thinking" from other sources. I will not attempt a definition here, but since I am addressing mathematicians, I can safely say that you should be familiar with it, since most of you do it. In object-oriented programming, however, there are also some important ideas needed that fall outside of traditional mathematical experience. The best way to proceed is to think about the foundations for some of the usual structures we encounter in mathematics, for example, polynomials.

Let's write the free module on a set X over a ring R as $\text{FreeModule}(R, X)$. Of course, in mathematics, there is no

trouble in realizing a functor such as "FreeModule", whose parameters (arguments) are a ring R and a set X and whose value is a module over R , as a concrete object.

Given the functor above, we can easily define all sorts of mathematical structures. For example, if we are given a monoid M , i.e., a set M with a binary operation $*$: $M \times M \rightarrow M$ which is associative and has an identity element, we can form the monoid ring of M over a ring R by defining an operation on $\text{FreeModule}(R, M)$ as follows. First define a function

$$M \times M \rightarrow \text{FreeModule}(R, M)$$

by simply "coextending" the given operation on M . Now extend this function bilinearly to

$$\text{FreeModule}(R, M) \times \text{FreeModule}(R, M) \rightarrow \text{FreeModule}(R, M).$$

This gives a mathematical structure which we will denote by $\text{MonoidRing}(R, M)$. Let's agree to call these functors "constructors" to emphasize the point that they produce new mathematical objects out of collections of others. It is now easy to see that we can get an object isomorphic to the usual polynomial ring in one indeterminate over a ring R by simply forming $\text{MonoidRing}(R, \mathbb{N})$, where \mathbb{N} is the monoid of natural numbers with addition. If we agree to write a linear combination $r_1 n_1 + \dots + r_k n_k$ where $r_i \in R$ and $n_i \in \mathbb{N}$ as $r_1 t^{n_1} + \dots + r_k t^{n_k}$, we obtain the usual representation of polynomials as well.

It might surprise you to find out that the polynomial ring in one indeterminate over an arbitrary ring R may be defined in *AXIOM* in exactly the above way. Furthermore, there are facilities for providing a wide range of display forms automatically (so elements of $\text{MonoidRing}(R, \mathbb{N})$ can indeed be made to display as polynomials in " t ").

Two important components of object-oriented paradigms are *encapsulation* and *inheritance*. In *AXIOM*, an abstract datatype has the properties of encapsulation (private and public parts, etc.). Datatypes in *AXIOM* are typically parameterized and represent mathematical structures. An important consequence of the object-oriented paradigm (in the above sense) is *polymorphism*, i.e., objects (programs and mathematical structures) can be reused in a variety of contexts. The abstract type $\text{FreeModule}(R, X)$ is parameterized by the abstract types Ring (the R parameter) and Set (the X parameter). Furthermore, note that the addition in $\text{MonoidRing}(R, M)$ comes from its "parent" $\text{FreeModule}(R, M)$ upon which it is built. This is an example of inheritance. In this light it is clear that these aspects of object orientation have been present in mathematics for quite some time.

Concepts falling outside of the traditional mathematical experience, but relevant in a discussion of object-oriented methods, are the notions of dynamic binding and dynamic dispatch as well as dynamic memory allocation and automatic garbage collection. We will not go into detail concerning these concepts here, but the interested reader will find more information in the references [C], [MW]. Object-oriented languages do not have to have built-in memory management. C++ is an example.

None of the major computer algebra systems today have parameterized types built into the language except *AXIOM*. On the other hand, all of the major computer algebra systems have some form of dynamic allocation and automatic garbage collection built in. It is fair to say that these latter concepts are what make symbolic computation systems so attractive to most researchers. Without them a user is not free to spend all of his time concentrating on mathematical concepts. Instead, he or she must, for example, constantly make sure that there is enough memory available for a process which may be growing in a way that is not measurable before execution and also come up with some scheme for reclaiming memory that has been used, but which will not be used again unless steps are taken to make it so. Let me now go on to say some specific things about the six components of the *AXIOM* system given above.

First, there is the interactive environment. Among computer algebra systems, *AXIOM* is unique in the way that it dynamically builds datatypes based on user input. If you enter $x * 2 + 1/3$, it will build polynomials with rational coefficients. If you enter $x * 2 + 0.333 * \%i$, it will create polynomials with complex coefficients. Type inferencing also applies to function definitions. You can define a function f by $f(x) == x * 2$. If f is applied to an integer, the type of f is chosen to be $\text{Integer} \rightarrow \text{integer}$. If f is applied to a rational function such as $1/(x + 1)$, the type of f is chosen to be

$\text{Fraction Polynomial Integer} \rightarrow \text{Fraction Polynomial Integer}$,

etc.

Occasionally, type declarations are necessary. *AXIOM* provides for that. For example, to declare x to be a polynomial with integer coefficients you may use the syntax $x: \text{POLY INT}$. In fact, all of the choices *AXIOM* makes can be made instead by the user, if desired.

The hypertext facility is called "HyperDoc" in *AXIOM*. A sequence of windows is displayed on the next page. The windows should be read from left to right and top to bottom. Beginning with the "HyperDoc" window, the next window was obtained by clicking on "Basic Commands". The "Series" field was clicked on to give the third window, "Series Basic Command", and in that window the choice for "Formula" was chosen. This produced the fourth window, "Power Series Basic Command", in which "Puiseux Series" was chosen. That produced the fifth window. At this point some other choices can be made. It is possible to overwrite the data which automatically come up in the "Puiseux Series Basic Command" window and enter other data. This makes it convenient to experiment with *AXIOM*. The given data were chosen. By clicking on the "Continue" button, those data were used to create a valid *AXIOM* statement displayed in a new window labelled "Basic Command". Some other HyperDoc pages cause collections of statements to be generated. If the "Do It" button is clicked, the statement is executed in the

EXIT HELP

HyperDoc

This is the top level of HyperDoc. To select an item, move the cursor with the mouse to a word in **this font** then click a mouse button. For an introduction to HyperDoc, click on **HELP**.

What would you like to do?

- **Basic Commands** Solve problems by filling in templates.
- **Topics** Learn how to use Axiom, by topic.
- **Browse** Browse through the Axiom library.
- **Examples** See examples of use of the library.
- **Reference** Scan on-line documentation on Axiom.
- **Settings** Axiom system commands and variables.
- **HyperDoc** Write your own HyperDoc.

EXIT

Basic Commands

- **Calculus** Compute integrals, derivatives, or limits
- **Matrix** Create a matrix
- **Draw** Create 2D or 3D plots.
- **Series** Create a power series
- **Solve** Solve an equation or system of equations.

EXIT

Series Basic Command

HOME 

Create a series by:

- **Expansion** Expand a function in a series around a point
- **Formula** Give a formula for the i 'th coefficient

EXIT

Power Series Basic Command

HOME 

Select the kind of power series you want to create:

■ **Taylor Series**

Series where the exponent ranges over the integers from a *non-negative integer* value to plus infinity by an arbitrary *positive integer* step size

■ **Laurent Series**

Series where the exponent ranges from an arbitrary *integer* value to plus infinity by an arbitrary *positive integer* step size

■ **Puiseux Series**

Series where the exponent ranges from an arbitrary *rational* value to plus infinity by an arbitrary *positive rational* number step size

EXIT

Puiseux Series Basic Command

HOME 

- Enter the *formula* for the general coefficient of the series
 $(-1)^n * ((3*n - 4)/6) / \text{factorial}(n - 1/3)$
- Enter the *index variable* for your formula n
- Enter the *power series variable* x
- Enter the *point* about which you want to expand 0

For Puiseux Series, the exponent of the power series variable ranges from an *initial value*, an arbitrary rational number, to plus infinity; the *step size* is an any positive rational number.

- Enter the *initial value* of index (a rational number) $4/3$
- Enter the *step size* (a positive rational number) 2

Continue

EXIT

Basic Command

HOME 

Here is the Axiom command
 you could have issued to compute this result:

```
series(n +> (-1)**((3*n - 4)/6)/factorial(n - 1/3), x =
0, 4/3.., 2)
```

Do It

Select Exit to make this window go away.

original *AXIOM* interpreter automatically. Here is the result:

```
(1) ->series(n +--(-1)**((3*n - 4)/6)/
      factorial(n - 1/3),x = 0,4/3..,2)
```

$$(1) \quad x^4 - \frac{1}{6}x^3 + 0(x)^5$$

Type:

UnivariatePuisseuxSeries(Expression Integer,x,0).

There are also facilities for causing new interpreter windows to pop up and execute *AXIOM* commands automatically (e.g., using the “Examples” field of the HyperDoc window). Also, by clicking on the “HyperDoc” field of the HyperDoc window, you can learn how to write your own HyperDoc lessons on any subject you like along the lines of what has been explained (and more).

The system has a convenient browser that lets you find out about a domain’s operations, attributes, ancestors in the hierarchy, and cross references. All of this is HyperDoc oriented.

There are tutorials in HyperDoc that cover the basic graphics. The first procedure that I will describe is the “draw” function. This function can be used quite naturally and simply, as in the command

```
draw(x**2,x=-1..1)
```

which causes a window to pop up with the graph of the given parabola in the given range. It can, however, also be embellished somewhat, as in the command

```
draw(tan x,x=-2*%pi..2*%pi,
      clip==true,curveColor==blue()).
```

There is a wide range of draw options, and they are accessed by the syntax indicated above. The “Clip” option as written turns clipping on, i.e., large values are shut off (the user can adjust the maximal value, if desired). Many more examples of this sort of thing are given in the book [JS], and complete information is available through hyperdoc.

The user can graph parametric equations and surfaces through the use of the draw procedure as well. In fact graphs may be manipulated as objects in *AXIOM*. For a bit of whimsey, the built-in procedure “makeObject” was used to produce the picture given on this page. The *AXIOM* code is quite straightforward, and the first part of it is given here.

```
ruled(y1,y2,y3,g1,g2,g3) ==
-- create expressions for the parameterization
x : EXPR INT := y1 + s * g1
y : EXPR INT := y2 + s * g2
z : EXPR INT := y3 + s * g3
-- return the three coordinates
[x,y,z]
```

```
sphere(r,a,b,c) ==
  x : EXPR INT := r * cos(u) * cos(t) + a
  y : EXPR INT := r * cos(u) * sin(t) + b
  z : EXPR INT := r * sin(u) + c
  [x,y,z]

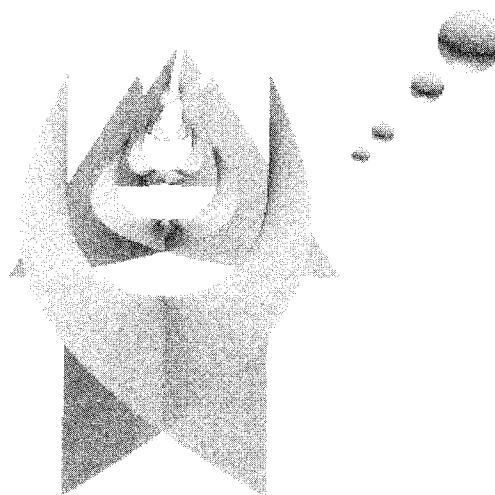
xx := ruled(t,t**2,1,cos(t),sin(t),t)

sp := makeObject(surface(xx.1,xx.2,xx.3),
                  t=-%pi/2..%pi/2,s=-2..2,
                  var1Steps==35,var2Steps==35)

xx := ruled(t/2,t**2,1,cos(t)/2,sin(t)/2,t/4)

makeObject(surface(xx.1,xx.2,xx.3+1.2),
            t=-%pi..%pi,s=-2..2,space==sp,
            var1Steps==35,var2Steps==35)
```

Modern Art (?)



The first call to makeObject creates the object sp, and the next one given above has the draw option space==sp which causes the graph argument to be added to the space sp. Following the lines indicated above, more scaling was done, more graphs were added to the space, and then spheres of various radii and locations were added. A more mathematical use of *AXIOM*’s graphical facilities can be found in [LL].

Moving on to *AXIOM*’s object-oriented compiler, let me refer the reader to the 1989 article [L1], where the basic concepts are discussed, and the book [JS]. Version 2.0 of *AXIOM* will provide a compiler for the A# programming language which has a syntax similar to the current compiler for *AXIOM* but which generalizes many concepts and produces more efficient code. In addition, with A# in place, the user will be able to take advantage of interlanguage communications.

Programming: Systems, Languages and Applications, ACM Press, New Orleans, LA, 1989, pp. 23–35.

The compiler is used to produce the *AXIOM* library and can also be used by any user to produce new library files (or even replace system files). It would be impossible to list all of the mathematical expertise built into *AXIOM* in this space. The 742-page book [JS] is a good but brief introduction to what is present. To get an idea of the level of abstraction and extensibility possible, the reader might want to take advantage of the (p)reprint series at NAG, Inc. Send e-mail to Dr. Richard Luczak (rl@nag.com) for more information.

For an application of the full power of *AXIOM*'s compiler and the interactive mathematical environment, let me point to [L2] and [L3], where it was used to set up categories and domains of computation in order to derive formulas in a complex area of algebra, and [AB], where it was used to discover an unexpected theorem enabling the authors to give simpler proofs of results in [A]. (It is due to a large backlog that [AB] has appeared before [A]!) The reference [L2] also contains general information about the system.

Finally, release 2.0 of *AXIOM* will also have the "NAG-Link" in place. This is a facility which uses *AXIOM* and HyperDoc to link to the NAG FORTRAN library software over a network so that *AXIOM*'s environment can be used to manage accurate numerical calculations involving root finding, interpolation, optimization, integration, ODEs, PDEs, and statistical applications.

For general information contact John Zurawski at NAG, INC., 1400 Opus Place, Suite 200, Downers Grove, IL 60515 (johnz@nag.com).

For questions about *AXIOM* and technical support you may contact: Tom Ryan (ryan@nag.com) for the academic environment; Sheila Caswell (caswell@nag.com) or Tony Nilles (nilles@nag.com) for the industrial or government environments; and axiom@watson.ibm.com for technical support. Outside the United States contact infodesk@nag.co.uk.

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Object Logo™

Student Edition

Reviewed by Suzanne M. Molnar*

Object Logo™ Student Edition is an implementation of the programming language *Logo* for the Macintosh. It is available from Paradigm Software Inc. (P.O. Box 2995, Cambridge, MA 02238; 617-576-7675) for \$49.95. System requirements include a Macintosh Plus computer or greater with at least 1 megabyte of RAM (2 are recommended) and System 6.0.4 or later. The software is compatible with System 7 with 24-bit addressing. For the purpose of this review it was run on a Macintosh II with 5 megabytes of RAM and System 6.0.7.

Object Logo™ Student Edition provides the functionality of the mathematics and list processing of *Logo* and **turtle geometry**. In addition it supports an object-oriented programming environment. The full version of *Object Logo™* (\$195.00) includes a file compiler, application generator, MIDI (music) and robotics modules, and a complete 465-page *Object Logo™ Reference Manual*. At the time of this writing the full version was available for \$135.00 for owners of the Student Edition.

The *Student Edition* comes with the 186-page book *Logo for the Macintosh: An Introduction through Object Logo™* by Harold Abelson and Amanda Abelson [1]. After working through the first few chapters, the user has the groundwork for further exploration into turtle geometry, recursion, and list processing even if one has not programmed. This is a primary advantage if *Object Logo™* is to be used by students with little or no programming background. If you have familiarity with the programming language LISP, from which *Logo*'s use of lists is adapted, the learning curve is a straight line with small slope!

There are three windows available to the user of *Object Logo™*, illustrated in Figures 1 and 2 on pages 19 and 20, respectively. When *Object Logo™* begins, the Listener window appears with the ?-prompt. This is the window where interactive sessions occur. The Graphics window (or turtle window) also appears upon start-up, provided the *Object Logo™ Elementary file*—the program which controls turtles from the keyboard, mouse, and menu—is placed in the Startup Folder. One turtle appears at the center of this window. The third window is the file window for creating, editing, and saving programs.

Since *Object Logo™* is interactive, procedures may be written in the Listener window without using the file window. The transcript of the Listener session can be saved but will not run, as it has responses interspersed with commands.

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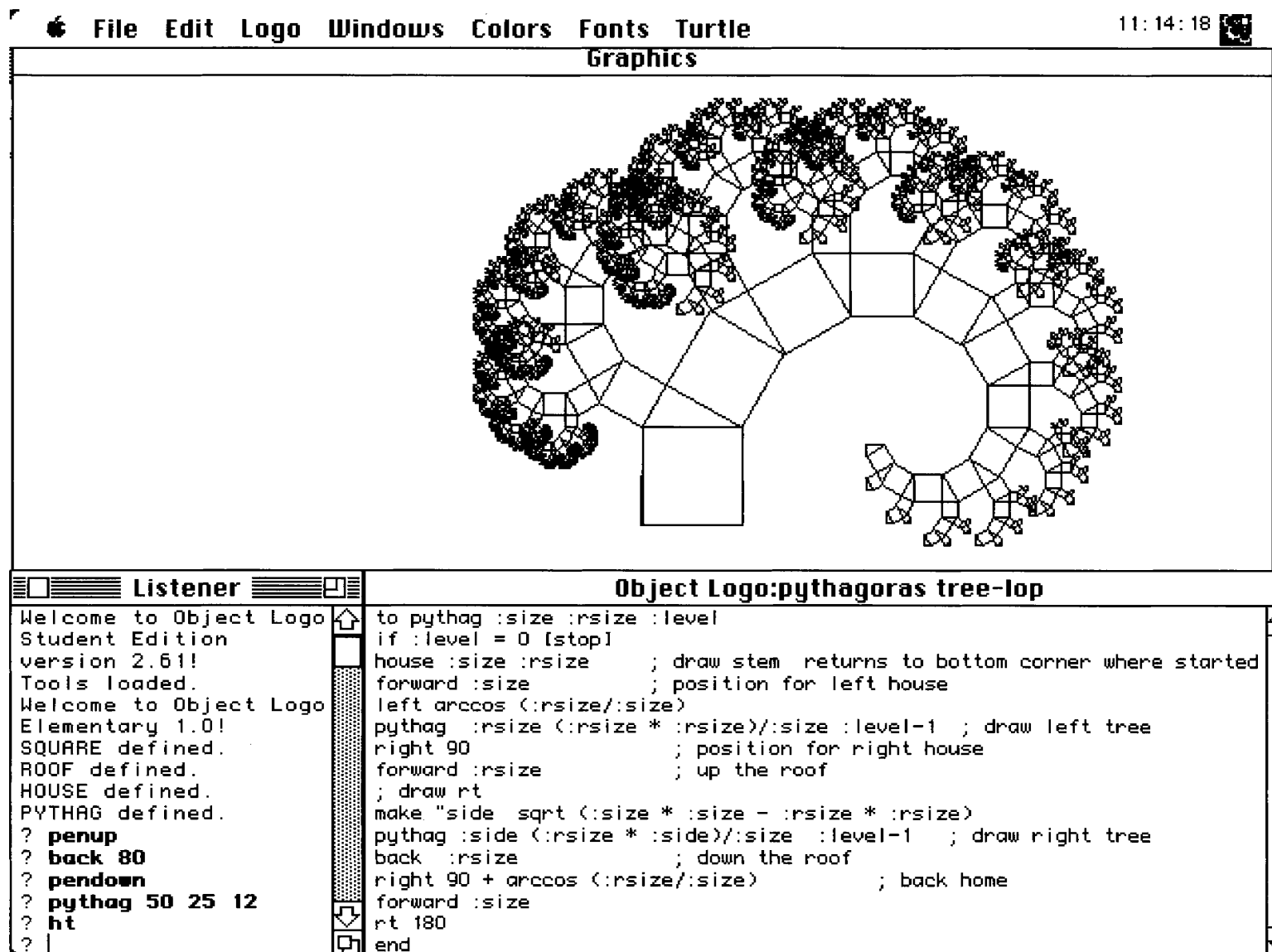


Figure 1

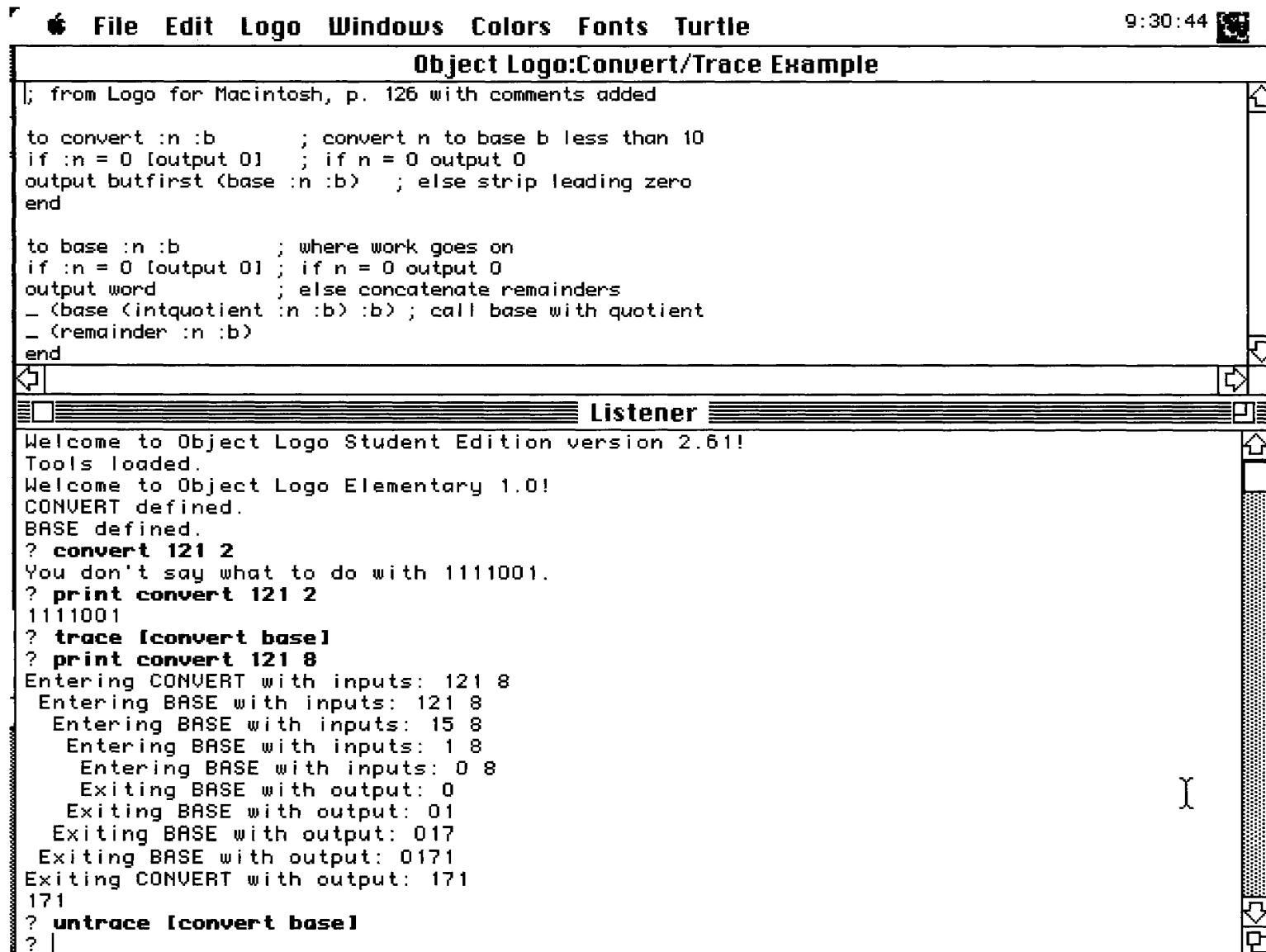


Figure 2

In developing the procedures to draw the Pythagorean tree (Figure 1), the Listener window is invaluable for guiding the turtle through its moves, one elementary instruction at a time. The file window is where the final procedures were developed. As with most LISP editors, the *Object Logo*TM editor has the advantage of alerting the user visually to the matching left bracket (or left parenthesis) when its mate is keyed. If only *Mathematica* [2] would do this! One minor annoyance: if several new files are created, all are given the name "Untitled", with no numeric designation. If Window is chosen from the Menu bar, several "Untitled" files are listed. In a development environment, it is unnecessary to save every attempt. Thus, having temporary "Untitled" files followed by a number is a feature most Macintosh applications allow.

Once a set of procedures is saved, double-clicking on the file icon starts *Object Logo*TM, loading the procedures contained in that file. The Listener window in Figure 1 shows the four drawing procedures being loaded. To position the turtle to allow the entire tree to appear on the screen, three turtle commands are keyed, followed by the call to "pythag", which draws the tree. The original square is size 50, one side of the original triangle is size 25, and the depth of the recursion is 12. The **ht** (or **hideturtle**) command is used for the screen save; there is no need for the command if the Graphics window is being printed directly from *Object Logo*TM. Output of the graphic directly from *Object Logo*TM is far superior to that of the screen dump in Figure 1.

While developing procedures in the file window, one can try them out by selecting them, then choosing Run Selection from the **Logo** menu. If the syntax is correct, the procedure names will appear in the Listener window. If the code is incorrect, appropriate error messages appear. The similarity to a LISP programming environment is evident in debugging support through step and trace commands (Figure 2). There is also a Watch window for viewing how specified variable values change. The Student Edition does not allow files to be compiled; the full version of *Object Logo*TM does.

One of the beauties of *Object Logo*TM is that recursion comes easily and visually, too. Not only can a binary tree be defined recursively, but one can see it grow. If you compare the *Object Logo*TM code which produced Figure 1 to Lauwerier's BASIC code [3] for a similar diagram, there is no question that computer languages influence the thinking process. This is why *Logo* has a long tradition of use by children [4]. Like programming in LISP, procedures can be built incrementally from the bottom up, as seen by the procedures defined in Figure 1. "Square" draws a generic square; "Roof" draws a right triangle with a given hypotenuse; "House" draws a single house; "Pythag" is a variation on drawing a binary tree, except it draws "Houses" instead of branches. *Object Logo*TM supports arithmetic operations and the usual functions such as "sqrt" and "arccos" used in Figure 1. Arithmetic operations are entered in infix notation, unlike LISP which uses prefix notation. The tree was drawn with no need to know any coordinate system or coordinate values. The turtle merely had to be moved back a bit so the entire tree would fit in the Graphics window. There is a **setxy** turtle command for

specifying the turtle's position which could have been used instead.

Ease of use and turtle graphics should not detract from the fact that *Object Logo*TM has the capabilities of list processing languages like LISP and supports object-oriented programming. The latter paradigm allows one to create objects, and by means of inheritance, create new objects from other objects. It is therefore possible to use *Object Logo*TM to design versions of two "classic" programs: one which recognizes animals and another which carries on a conversation with a therapist [1].

*Object Logo*TM has the flexibility to be used in a variety of settings, namely, as an introduction to programming or as a painless way for students at various levels of mathematical maturity to acquaint themselves with recursion and fractals. I intend to make use of *Object Logo*TM to introduce symmetry of scale and fractals in a liberal arts mathematics course for non-majors [5]. Although binary tree variants, Koch snowflakes, and Sierpinski triangles can be drawn using *Mathematica* [2,6,7], students should find initial experimentation with such designs more appealing and intuitive in *Object Logo*TM.

Paradigm Software has available additional books and disks for using *Logo* with a college audience. They are included in the references below [8–11]. *Investigations in Algebra* is for exploring combinatorics, number theory, and discrete functions; *Turtle Geometry: The Computer as a Medium for Exploring Mathematics* is an invaluable reference.

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Fields&Operators

Reviewed by Jim Northrup*

Fields&Operators is an interactive Macintosh graphics program for viewing curves, surfaces, and fields in either two or three dimensions. Its ability to calculate closed-form derivatives makes it more than just another plotting package but less than a full-blown symbolic computation package such as *Maple* or *Mathematica*. Accordingly, *Fields&Operators* fills a specialized niche in the spectrum of plotting packages. Although I found a few minor bugs in the software, I believe its overall facility would make it a welcome tool in many vector calculus classes.

Basic Layout

The basic layout of *Fields&Operators* is a single graphics window composed of **layers** of images, similar to the **layers** concept commonly encountered in Macintosh drawing programs. A single layer contains an image of just one surface, curve, or field. More complex drawings can be built by piling layers on top of each other. For example, a user could draw a surface on one layer, its level sets on a second layer, a tangent plane on a third layer, etc. All of these layers are visible to the viewer simultaneously, as if each layer were drawn on transparent viewgraphs. A single document can contain up to ten layers total, depending on available memory.

What many users will be unfamiliar with is the fact that only one document at a time can be opened by the *Fields&Operators* application. For instance, it would be cumbersome to copy an image from one document and paste it into another, since both documents could not be open at the same time. The point is moot, however, since *Fields&Operators* does not even allow pasting of images. Both of these shortcomings run counter to the typical look-and-feel associated with Macintosh applications and are accompanied by other "un-Macintosh-like" features. For example, opening a document does not immediately render the document's graphics image on the screen; rather, the user must explicitly render the image by selecting the **Draw** item from the **Draw** menu. Given the software's sluggish rendering speed, I would rather tell the software when to render an image than let it decide. Thus, one could consider this last aspect of the software a feature rather than a bug.

Interface issues aside, *Fields&Operators* does offer an excellent array of drawing capabilities. It can render curves, surfaces, or vector fields in either rectangular, spherical, or cylindrical coordinates. *Fields&Operators* can compute gradients, divergences, curls, Laplacians, and partial derivatives in closed form. It can generate tangent planes automatically and compute flow diagrams numerically. One of my favorite

features of *Fields&Operators* is its ability to obtain function values from a text file; for example, a numerical analyst might use this software to present data graphically generated by some external C or FORTRAN code.

Each graphics layer in a drawing has associated with it a window which determines what will be presented in that layer (e.g., the graph of a function or the graph of an operator applied to a function). Normally these auxiliary windows are hidden behind the main graphics window and are pulled to the front by means of the **Layers** menu item. Figure 1 (see next page) shows such an auxiliary window, one associated with a tangent plane layer.

Graphics & Animation

Fields&Operators can draw either wireframe or shaded images. Shaded images can be either solidly shaded or dithered, though I found the dithering option presented a less useful 3-D effect than solid shading. The user has explicit control over the domain of the drawing (though the domain must always be a rectangle) and the display of axes. Singularities are detected by determining when the function exceeds some set value, rather than by any algebraic means, but the user does have explicit control of the cutoff value.

One of the nicest features of *Fields&Operators* is its ability to generate animations. Animation files are stored to disk as they are generated, so disk space can get used up quickly. While other user interfaces in this software seemed unduly cumbersome, the interface used to design animations is excellent. In a **rotation storyboard** the user is presented with a sequence of frames from the animation (up to twelve frames being presented on-screen at any one time). The object to be viewed is represented in each frame as a cube. Clicking on one of the frames and then clicking on either a zoom or rotate button causes that action (zoom or rotate) to be performed on all subsequent frames. The cube presented in each frame changes its orientation so as to reflect the selected transformation. The user does not have any control over the target of the observer's view, but since there is only one object in the view space, this seems like a reasonable concession to make in return for an easy-to-use animation interface. Figure 2 (see page 24) shows the animation storyboard as well as some vector field graphics.

Bugs & Problems

Overall I like *Fields&Operators*, but there are some problems that ought to be addressed. There are some outright bugs. For instance, opening a *Fields&Operators* document from the Macintosh Finder while the *Fields&Operators* application is running will cause the application to hang. The floppy disk on which *Fields&Operators* is distributed contains two folders: "Mac II (Color)" and "Mac Plus. SE (Black & White)". Each folder contains a different version of *Fields&Operators*, but these have nothing to do with color versus black & white; rather, the "color" version of the software assumes a floating point coprocessor, and either version will run in color. (Apparently the folders were named before Classics,

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LCs, Performas, Quadras, Centrises, and Powerbooks became popular.)

I ran the black & white version of *Fields&Operators* on a Macintosh LC II (with 256 colors) and on a Powerbook 160 (with sixteen shades of gray). On both of these machines *Fields&Operators* rendered images frustratingly slow. (It took thirty seconds to render the "Horn with Tangent" shown in Figure 1 on an LC II.) It is understandable that the initial rendering might be slow, but subsequent rendering when an image was "exposed" by window movement was also slow, as if the Macintosh were recomputing some of the image data rather than refreshing an already rendered bitmap. The shading of objects seemed to take advantage of very few colors, and the dithered shading added no depth cues at all to three-dimensional images. As shown in Figure 2, the vector fields graphics tend to look jagged (however, one can request thinner arrows from a **vector parameters** dialog box).

In general, the interface is somewhat cumbersome (with the notable exception of the rotation storyboard) and "un-Macintosh-like". All in all, this package gives the impression that the authors concentrated on mathematics rather than on the interface. Certainly this is the proper priority; and given the package's wide array of capabilities, I can tolerate some

small interface problems and minor bugs. Still, I would like to see an improved version of the interface, especially if I were going to turn it over to students.

Summary

Fields&Operators is a good graphics program that fills a unique and specialized niche. If used as course software, it might not provide all of the functionality I would want for a first-year calculus course, but it would be very useful in a vector calculus course. Additionally, its ability to read function data from text files makes it useful for visualizing data obtained from other software, and the package may be useful as a research or presentation tool as well. Though *Fields&Operators* does perform closed-form calculation of derivatives, it does not (nor is it intended to) provide all of the graphics or computation capabilities of a large symbolic computation package. Still, at only 185K of disk space and 384K of RAM, it provides much more capability than many other small graphics packages. The interface is a bit cumbersome, and the quality of the graphics could be improved; but all in all it is a good, useful package.

Fields&Operators is available from Lascaux Graphics, 3771 E. Guthrie Mt. Place, Tucson, Arizona 85718.

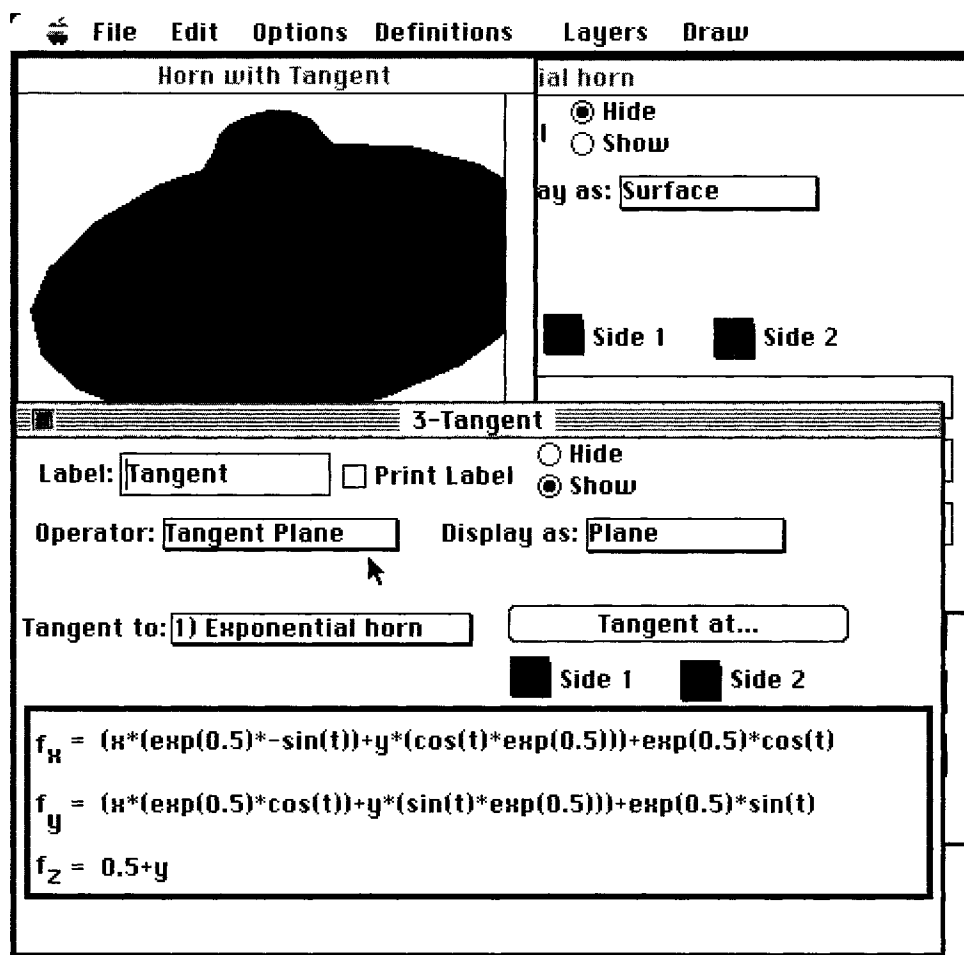


Figure 1. Two layers: a surface and its tangent plane; also, the tangent planes defining window.

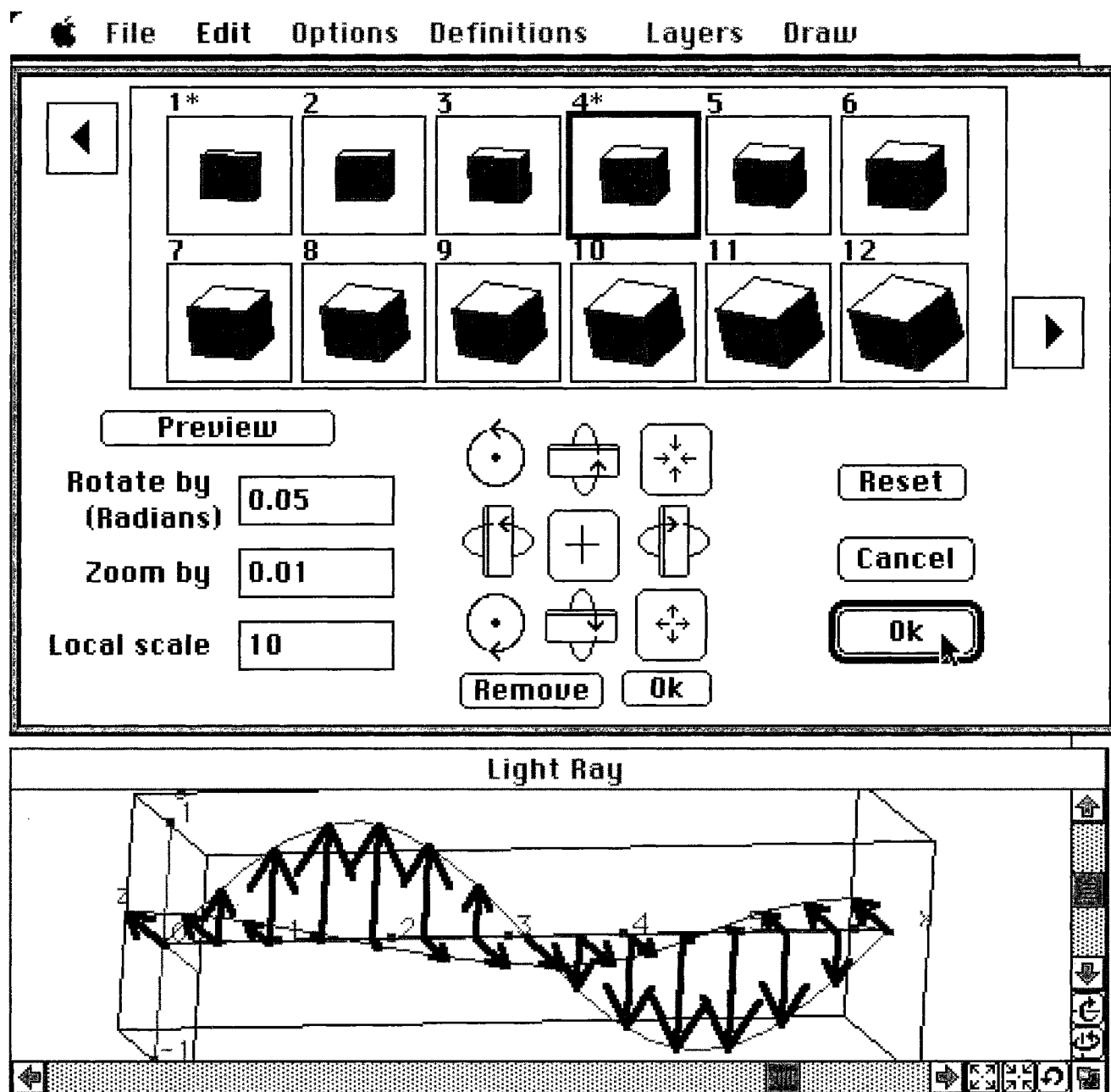


Figure 2. Rotation storyboard and vector field graphics.

Inside the AMS

Trjitzinsky Awards Announced

The Society has announced the names of four undergraduate mathematics majors who have received awards through the Waldemar J. Trjitzinsky Memorial Fund. The fund is made possible by a bequest from the estate of Waldemar J., Barbara G., and Juliette Trjitzinsky. The will of Barbara Trjitzinsky stipulates that the income from the bequest should be used to establish a fund in honor of the memory of her husband to assist needy students in mathematics.

Each year the Society selects four geographically distributed schools which in turn make one-time awards of roughly \$2,500 each to mathematics undergraduates to assist them in their pursuit of careers in mathematics. The schools are selected in a random drawing from the pool of AMS institutional members. This year the four institutions receiving the award funds were the University of California at Los Angeles, the State University of New York at Geneseo, Eastern New Mexico University, and the University of Virginia.

UCLA presented its award to MICHELLE L. LANIR, a junior in mathematics/applied science. She is specializing in operations research and is considering further study in the Graduate School of Management and in computer science. Ms. Lanir has been on the Dean's Honor List twice and was an Alexander-Bee Scholar three times. She is a member of the UCLA College Honors Program and the UCLA Actuarial Club. In addition to her studies she works twenty hours a week at a credit union and as a mathematics tutor for the UCLA Athletics Department.

SUNY Geneseo selected JODI C. WRIGHT for its award. Ms. Wright has attended SUNY Geneseo since 1991. A student with an excellent high school record, Ms. Wright is continuing to do very well in her college work, maintaining a grade point average of 3.8. In addition to majoring in mathematics Ms. Wright is pursuing course work in secondary education.

Eastern New Mexico University presented its award to REBECCA K. MOORE, a single parent with a four-year-old daughter. Currently a mathematics major, Ms. Moore intends to earn a Ph.D. in mathematics and teach at the university level. Thurman Elder, chair of the mathematics department, said, "Ms. Moore is very deserving of this award. She is bright and has a genuine interest in mathematics. She has been concerned about being able to continue school in the fall because her student loan has not been awarded. However, the

Waldemar J. Trjitzinsky award now makes it possible."

The University of Virginia made its award to MIKHAIL KRICHMAN. Mr. Krichman was born in Tashkent, Uzbekistan. He studied mathematics at the University of Tashkent until his family emigrated to the United States in 1988. He is currently a fourth-year mathematics major at Virginia. "I think that my early fascination with mathematics can be linked with my interest in music, which I also displayed when I was still very young," wrote Mr. Krichman in an autobiographical statement he prepared for receiving the award. "Now I find a lot of similarities between mathematics and music, probably because both of them are the attempts to find some kind of harmony in our dissonant and contradictory world." He intends to pursue a Ph.D. in mathematics and become a mathematics professor.

For more information about the Trjitzinsky Fund contact Timothy J. Goggins, Development Officer, AMS, P.O. Box 6248, Providence, RI 02940-6248.

AMS Program Development Fund

*Timothy J. Goggins,
AMS Development Officer
and Assistant to the Executive Director
for International Affairs*

The Executive Committee and Board of Trustees (ECBT) recently voted to establish a Program Development Fund and to ask members to make contributions to it as part of the membership dues billing. In doing so the ECBT recognized the varied and substantial challenges confronting the Society's mission to promote mathematical scholarship and research and the need to set aside General Fund monies to specifically address these challenges.

The ECBT also recognized an opportunity for the Society to invest its unrestricted member support in mission-related programmatic initiatives. For example, the new publication *What's Happening in the Mathematical Sciences* used this concept to attract broader outside support from the Exxon Education Foundation and the Alfred P. Sloan Foundation.

In the June 1994 membership dues notifications the check-off box for the General Fund will be replaced by a check-off box for the Program Development Fund.

Traditionally the Society has supported mathematical scholarship and research through its Centennial Fellowship and prize funds. This emphasis will continue and expand. At the time the Board established this new fund, it also voted to match all gifts to *both* the Centennial Fellowship Fund and the Program Development Fund on a dollar-for-dollar basis up

to \$50,000 for each fund. Revenue to support the match will be taken from the income earned each year on the Society's endowment.

Finally, each year a report on the disbursement of Program Development Funds will be published in the *Notices* so that members can follow closely the use of their donations.

CONTEMPORARY MATHEMATICS

Algebraic Topology: Oaxtepec 1991

Martin C. Tangora, Editor
Volume 146

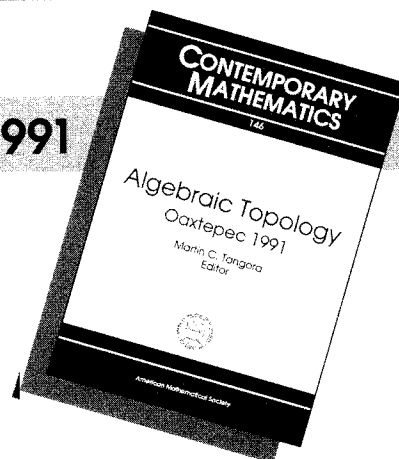
This book consists of twenty-nine articles contributed by participants of the International Conference in Algebraic Topology held in July 1991 in Oaxtepec, Mexico. In addition to papers on current research, there are several surveys and expositions on the work of Mark Mahowald, whose sixtieth birthday was celebrated during the conference. The conference was truly international, with over 130 mathematicians from fifteen countries. The papers range over much of algebraic topology and cross over into related areas, such as K -theory, representation theory, and Lie groups. Also included is a chart of the Adams spectral sequence and a bibliography of Mahowald's publications.

1991 *Mathematics Subject Classification*: 55; 00

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Graph Structure Theory

Neil Robertson and Paul Seymour, Editors
Volume 147

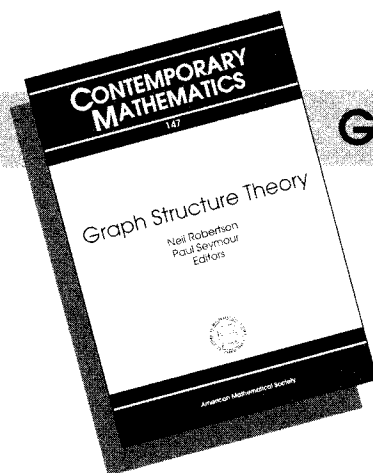
This volume contains the proceedings of the AMS-IMS-SIAM Joint Summer Research Conference on Graph Minors, held at the University of Washington in Seattle in the summer of 1991. Among the topics covered are: algorithms on tree-structured graphs, well-quasiordering, logic, infinite graphs, disjoint path problems, surface embeddings, knot theory, graph polynomials, matroid theory, and combinatorial optimization.

1991 *Mathematics Subject Classification*: 05; 57, 06, 68

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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).

President Clinton Establishes National Science and Technology Council to Coordinate Federal R&D

During his campaign for president, Bill Clinton expressed faith in science and technology as engines of economic growth and hinted he would elevate science and technology policy to a level of highest concern in his administration. Late last year, President Clinton fulfilled many expectations when he issued an executive order establishing the National Science and Technology Council (NSTC).

According to a White House news release, "The principle purposes of the NSTC will be to establish clear national goals for federal science and technology investments and to ensure that science, space, and technology policies and programs are developed and implemented to effectively contribute to those national goals." The president himself will chair this cabinet-level body, which is intended to function as do the National Security Council and the Economic Policy Council.

The NSTC was originally proposed by the National Performance Review, a set of recommendations to improve the workings of nearly every federal entity formulated under the leadership of Vice-President Al Gore. The new council will assume the responsibilities of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), as well as two other White House panels on space and materials.

The president has asked the NSTC Council to conduct an across-the-board review of the federal R&D budget to align spending priorities with national goals. The NSTC will establish nine committees to prepare coordinated R&D strategies and budget recommendations in the following areas:

- Health, Safety, and Food R&D
- Fundamental Science and Engineering Research
- Information and Communication R&D
- Environment and Natural Resources Research

- Civilian Industrial Technology R&D
- Education and Training R&D
- Transportation R&D
- National Security R&D
- International Science, Engineering, and Technology

The FY 1995 budget proposal, which the administration must release soon, will bear some marks of enhanced priority setting and interagency coordination, a process pioneered by FCCSET over the past several years. White House sources say the full review is expected to be completed in time for incorporation into the FY 1996 budget proposal a year from now.

The president also established at the same time a President's Committee of Advisors on Science and Technology (PCAST), a private-sector advisory group for the president and the NSTC. PCAST will consist of fifteen distinguished individuals in industry, education, and research and will be co-chaired by John Gibbons, the assistant to the president for science and technology and director of the Office of Science and Technology Policy (OSTP).

The president envisions PCAST as a forum for seeking advice from the private sector on orienting federal investments in science and technology toward national goals and as a mechanism to encourage public-private partnerships, such as the Clean Car Initiative the administration developed last year with U.S. auto makers.

Congressman Rick Boucher (D-VA), chair of the House Science Subcommittee, has introduced legislation to codify Clinton's plans for the NSTC and PCAST, and thereby institutionalize the increased visibility of science and technology within the White House policy-making apparatus.

His bill would amend the National Science and Technology Policy, Organization, and Priorities Act of 1976—which established OSTP and FCCSET—to require annual submission of a consolidated R&D budget that identifies the president's priorities for science and technology and the societal goals those priorities are designed to address.

The bill would go even further than Clinton with a proposal to establish a National Sciences and Technologies Assessment Panel to assess the nation's performance in critical technologies and major fields of research. Such a panel would be in keeping with recommendations made in a recent report from the Committee on Science, Engineering, and Public

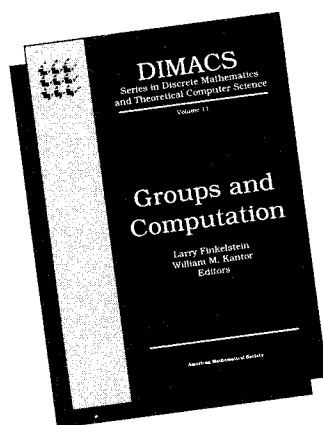
Policy of the National Academy of Science called, "Science, Technology, and the Federal Government: National Goals for a New Era."

Boucher's bill also adopts the primary recommendation of that report by declaring as policy that the U.S. "should be among the world leaders in all major areas of science and should maintain clear leadership in selected major areas of science." The decision to select a field for clear leadership

would be based on how it contributes to the national goals identified by the NSTC.

With or without the Boucher bill, the Clinton administration clearly intends to reshape the federal science and technology policy process in order to maximize the contributions of federal research and development to the health and prosperity of the nation.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science



Groups and Computation

Larry Finkelstein and William M. Kantor, Editors
Volume 11

This volume contains papers presented at the Workshop on Groups and Computation, held in October 1991. The workshop explored interactions among four areas: symbolic algebra and computer algebra, theoretical computer science, group theory, and applications of group computation. The papers also discuss such topics as parallel algorithms for groups, computation in associative algebras, asymptotic behavior of permutation groups, the study of finite groups using infinite reflection groups, combinatorial searching, computing with representations, and Cayley graphs as models for interconnection networks.

1991 *Mathematics Subject Classification*: 20

ISBN 0-8218-6599-4, 313 pages (hardcover), September 1993

Individual member \$41, List price \$69, Institutional member \$55

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Network Flows and Matching First DIMACS Implementation Challenge

David S. Johnson and Catherine C. McGeoch, Editors
Volume 12

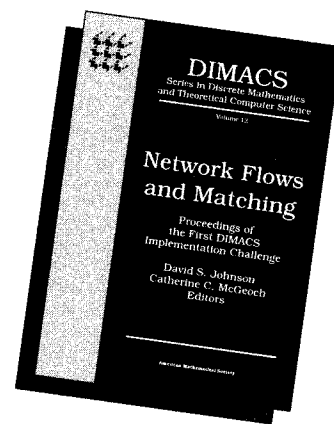
The DIMACS Implementation Challenge was organized to encourage experimental work in the area of network flows and matchings. Participants at sites in the U.S., Europe, and Japan undertook projects between November 1990 and August 1991 to test and evaluate algorithms for these problems. The Challenge culminated in a three-day workshop held in October 1991 at DIMACS. This volume contains the revised and refereed versions of twenty-two of the papers presented at the workshop, along with supplemental material about the Challenge and the Workshop.

1991 *Mathematics Subject Classification*: 68, 90

ISBN 0-8218-6598-6, 592 pages (hardcover), October 1993

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News and Announcements

James Wallace Givens, Jr. 1910–1993

James Wallace Givens, Jr., died on March 5, 1993, in El Cerrito, California. He had moved to California in 1979 on his retirement from Northwestern University. He is survived by his former wife, Virginia Shelton Givens (Berkeley, California); their three sons, James Wallace Givens III (Berkeley), Brian Hughes Givens (Richmond, California), and Barry Shelton Givens (Davis, California); and four grandchildren.

The name of Givens is known to numerical analysts mainly because of the Givens rotations—plane rotation matrices that arise in eigenvalue computations. This approach to computing eigenvalues by reducing a symmetric matrix to a tridiagonal form was developed by Givens during the 1950s. It is indicative of his love for the elegance of mathematics that this fundamental contribution was motivated by a paper on matrices over finite fields. Gene Golub and Beresford Parlett, in the January 1991 issue of the *SIAM Journal on Matrix Analysis and Applications* which is dedicated to Givens, point out that Givens's method was "the first round-off error analysis of matrix computations that was deliberately made in the 'backward' mode". Givens's analysis, published as an Oak Ridge National Laboratory technical report, is entitled "A Method of Computing Eigenvalues and Eigenvectors Suggested by Classical Results on Symmetric Matrices". Although never published in an archival journal, the paper "did fall into the right hands", Golub and Parlett relate. "Wilkinson saw the great potential in backward error analysis and went on to

show that, contrary to current beliefs, floating-point computation was easier to analyze than fixed-point computation."

Givens developed an interest in and ability for mathematics early in life. Born in Alberene, Virginia, he graduated from high school at the age of fourteen and from Lynchburg College *cum laude* at the age of seventeen. His graduate career began at the University of Kentucky, continued at the University of Virginia, and was completed at Princeton University, where he received a Ph.D. in 1936 under the direction of Oswald Veblen. From 1935 to 1937, as Veblen's assistant at the Institute for Advanced Study, Givens developed an intense interest in projective geometry that was to continue throughout his career. Later, in the 1940s, after attending a series of lectures at Princeton in which von Neumann described his plans for a stored-program digital computer, Givens's interests expanded to include numerical computation. This new focus, together with his background in projective geometry, led to the development of his method for computing eigenvalues.

Givens held appointments in mathematics at Cornell University (1937–1941), Northwestern (1941–1946), the University of Tennessee (1947–1956), Wayne State University (1956–1960), and Northwestern again (1960) before becoming director of the Applied Mathematics Division (AMD) of Argonne National Laboratory in 1964. He was already familiar with the national laboratories, having served on the Oak Ridge National Laboratory Mathematics Panel for more than a decade. At Argonne he built on this experience, recruiting and nurturing an eclectic group

of applied mathematicians, computer scientists, and computer engineers to pursue research in support of the division's computing service activities. The group's interests included, for example, reactor mathematics, the mathematical foundations of quantum physics, automated theorem proving, computer languages, image processing, and computer performance monitoring. Givens had a remarkable skill for finding talented individuals and stimulating their interests in applied mathematics and computer science. Many of the early Argonne AMD staff members moved on to very successful careers at other academic, industrial, and government institutions, extending Givens's legacy far beyond Argonne.

At Argonne Givens maintained his interest in numerical linear algebra and continued a tradition he had initiated in 1957 while chair of the mathematics department at Wayne State. In that year he had organized a workshop on dense matrix computations that is sometimes referred to as "Gatlinburg 0", because it was the inspiration for the Gatlinburg meetings subsequently organized by Alston Householder. In the three following years, Givens was a lecturer at another set of remarkable gatherings of numerical mathematicians—the University of Michigan summer sessions on numerical analysis. The roster of participants in the summer programs he organized at Argonne was a similar "Who's Who" of numerical mathematics, especially numerical linear algebra and the numerical solution of partial differential equations.

Before the term "mathematical software" was invented, Givens advocated implementing state-of-the-art algorithms

and making them readily available for use by scientists and engineers. He recognized the importance of the numerical linear algebra algorithms in the computer language ALGOL that appeared in *Numerische Mathematik* and, with the assistance of J. H. Wilkinson, initiated a project for translating these algorithms into FORTRAN programs. He supported their distribution via AMDLIB, an early mathematical software library. Thus, he was instrumental in creating the environment for, and the forerunner of, EISPACK, the first of the ANL mathematical software PACKs.

In 1969, while at Argonne, Givens began a two-year term as president of SIAM. He also served on the SIAM Council for seven years from 1965 to 1971. In 1970, after retiring as division director and resuming his role as a senior scientist at Argonne, Givens returned to the study of Lyapunov mapping that he had partially completed and reported in a 1961 ANL paper, "Elementary Divisors and Some Properties of the Lyapunov Mapping $X \rightarrow AX + XA^*$." He continued to be interested in the development and implementation of numerical linear algebra algorithms, however, and especially enjoyed J.H. Wilkinson's annual summer visits to Argonne. In 1974 Givens received the prestigious Alexander von Humboldt Stiftung Award and visited Bonn; in the following year, he retired from Argonne and returned to Northwestern as a professor of mathematics. Wallace Givens will be remembered as one of the small group of pioneers who created the field of matrix computations, as a creative administrator who advocated support of basic research, and as a friend who helped many individuals launch their careers.

James C.T. Pool
Drexel University

(Reprinted with permission from *SIAM News*, July 1993.)

Treil Awarded 1993 Salem Prize

The Salem Prize for 1993 has been awarded to SERGEI TREIL of Michigan State University for his work on operator theory and complex analysis. The prize, established in 1968, is given each year to a young mathematician who is judged to have done outstanding work in the area

in which Raphaël Salem worked, primarily Fourier series and related topics. The selection committee for the 1993 prize consisted of J. Bourgain, V. Havin, Y. Katznelson, and E. M. Stein.

Humboldt Foundation Awards

The Alexander von Humboldt Foundation in Bonn, Germany, recently presented a number of awards and fellowships to distinguished mathematicians.

The Foundation presented the Humboldt Award for Senior American Scientists to the following mathematicians: JOHN CHIPMAN, University of Minnesota; R. KEITH DENNIS, Cornell University; JURIS HARTMANIS, Cornell University; CHRISTOPHER JONES, Brown University; CHARLES ANTHONY MICCHELI, IBM T.J. Watson Research Center; and JOSEPH WEIZENBAUM, Massachusetts Institute of Technology.

The following outstanding young mathematicians were selected for Research Fellowships for long-term collaborative research projects in Germany: THOMAS BRIDGES, Rijksuniversiteit Utrecht; PETER CLOTE, Boston College; JAMES DAVIS, Indiana University; DAVID GRABLE, Clemson University; TAIEN HSING, Texas A&M University; KEITH KEARNES, Harvey Mudd College; ALBERT MILANI, University of Wisconsin; FRANK NIJHOFF, Clarkson University; and JON GORDON WOLFSON, Michigan State University.

The following mathematicians have been selected for postdoctoral research in Germany under the Humboldt Foundation's Feodor-Lynen program. Through this program, German scholars holding a doctorate carry out research at institutes of former Humboldt guest researchers. Listed below are the names of the postdoctoral researchers, followed by the names and institutions of their U.S. hosts: SUSANN HENSEL, Wolfgang H. Fuchs and Ronald Kline, Cornell University; MARIO BONK, Frederick W. Gehring, University of Michigan; HANS-PETER KRUSE, Jerrold E. Marsden, University of California, Berkeley; and ANDREAS RIEDER, Raymond J. O'Neil Wells, Jr., Rice University.

See the Funding News section of this issue of the *Notices* for information on Humboldt Foundation programs.

Lewis Award Presented

The John Frederick Lewis Award of the American Philosophical Society (APS) has been presented to DAVID GILMAN ROMANO, Keeper of the Collection, Mediterranean Section, at the University Museum of the University of Pennsylvania.

The award recognized Romano's book *Athletics and Mathematics in Archaic Corinth* as the best book published by the APS in 1993. This book deals with literary, historical, epigraphical, and archaeological evidence which reveals the origins of the Greek Stadium in the sixth century B.C. In order to establish a starting line which gave each runner an equal chance to win, Greek architects had to be familiar with plane geometry, including the basic properties of the circle and pi. Romano is the first to demonstrate that sixth and fifth century B.C. Greek mathematicians knew of pi, even though the relationship is well known from second millennium sources in both Mesopotamia and Egypt.

The American Philosophical Society is an international organization which promotes excellence and useful knowledge in the sciences and humanities through scholarly research, professional meetings, publications, library resources, and community service.

Luc Vinet Named Director of CRM

In July 1993 Luc Vinet was appointed director of the Centre des Recherches Mathématiques (CRM) at the Université de Montréal. He succeeds Francis Clarke, who served as director of CRM for nine years and who remains as professor of mathematics at the Université de Montréal.

Vinet is currently a member of the Mathematical Physics Group at CRM and of the Department of Physics of the Université de Montréal. He did his undergraduate and graduate studies at the Université de Montréal, obtaining a Ph.D. in 1980. A year earlier he had received a doctorate at the Université Pierre et Marie Curie (Paris VI). He did postdoctoral studies at the Massachusetts Institute of Technology before returning to his alma mater in 1982 as University Research Fellow, sponsored by the National Science and

Engineering Research Council of Canada. In 1987 he became an assistant professor in the Department of Physics at Montréal and reached the rank of full professor in 1992. He has served as visiting professor at the Université Catholique de Louvain, MIT, and the University of California at Los Angeles. His research in physics centers on the study of symmetry and its related mathematical structures.

Appointments to NSF Advisory Board

A number of mathematical scientists have been appointed to the Mathematical and Physical Sciences (MPS) Advisory Committee for the National Science Foundation (NSF). The NSF's Advisory Committee for the Mathematical Sciences was disbanded as part of a federal effort to reduce the number of advisory committees in the government; it met for the last time in the spring of 1993. The MPS Committee will provide advice to the NSF for all of the disciplines under the MPS Directorate, which includes mathematics, physics, chemistry, astronomy, and materials science.

The mathematical scientists on the MPS Advisory Committee are Nancy Kopell of Boston University, Ettore Infante of the University of Minnesota, and Richard H. Herman of the University of Maryland at College Park. Also on the Committee is Edward E. David, who chaired the committees that produced the two "David Reports".

The MPS Advisory Committee also has "disciplinary subcommittees" to focus on the individual areas that come under the MPS directorate. On the mathematical sciences subcommittee are Mary Ellen Bock of Purdue University, Ronald G. Douglas of the State University of New York at Stony Brook, F. Alberto Grunbaum of the University of California at Berkeley, D. J. Lewis of the University of Michigan, and Margaret Wright of AT&T Bell Laboratories.

Talagrand to Give Pitcher Lectures

The next series of Everett Pitcher Lectures will be held February 7, 8, and 9, 1994, on the campus of Lehigh University in Bethlehem, Pennsylvania. The speaker will be Professor Michel Talagrand of the Ohio State University. The

title of his lectures is "Isoperimetric Inequalities and Concentration of Measure in Product Spaces".

The lectures are open to the public and are held in honor of Everett Pitcher, former secretary of the AMS. Pitcher served in the mathematics department at Lehigh from 1938 until 1978, when he retired as Distinguished Professor of Mathematics. Further information can be obtained by writing to Pitcher Lecture Series, Department of Mathematics, Lehigh University, Bethlehem, PA 18105; or by calling 215-758-3753.

News from the Mathematical Sciences Research Institute Berkeley, California

The fall semester of 1993 has been very active at the Mathematical Sciences Research Institute (MSRI) ("Emissary"). Our Differential Geometry program has been quite energetic, with a schedule that included four intensive workshops during the fall: Riemannian Metrics Satisfying Curvature Equations, Spaces of Negative Curvature, Comparison Geometry, and Spectral Geometry. The spring semester of 1994 promises to be even busier, as a second program on Probabilistic Methods and Dynamical Systems for Partial Differential Equations joins the continuing Differential Geometry Program. In conjunction with this program, MSRI will host an AMS-SIAM Summer Program in Probabilistic Methods for PDE's, described elsewhere in this issue.

In spring of 1994 MSRI will hold five workshops: Waves in the Ocean (February 7–11), Exterior Differential Systems, Submanifolds, and Control Theory (March 1–4), Dynamical Systems Methods Designed for PDE's (March 14–18), Harmonic Maps, Minimal Submanifolds, and Rigidity Questions (April 20–22), and Mesoscopic Modeling of Nonequilibrium Systems (May 23–27). For further information write c/o any of the workshop titles to MSRI, 1000 Centennial Drive, Berkeley, CA 94720.

Next year (1994–1995), MSRI will host a yearlong program in Automorphic Forms and a spring semester program in Complex Dynamics and Hyperbolic Geometry. For 1995–1996 we are planning

a yearlong program in Several Complex Variables, and other programs that are still to be determined.

In addition to its scientific programs MSRI has been working vigorously in new directions aimed at reaching out toward wider groups of people. A videotape based on our celebrated Fermat Fest will ship near the end of December. A toll free number is now available to order the videotape: 1-800-677-7001 (ask for part #3009a). This one-of-a-kind production begins with Andrew Wiles and ends with a song written and sung by Tom Lehrer.

This year we launched a human resources project, aimed at achieving substantially greater participation of underrepresented minorities at MSRI than is typical in the U.S. mathematical research community. Our top-level human resources advisory committee had a very productive first meeting in November, alongside our existing Scientific Advisory Council and Steering Committee, to make plans for changing the face of MSRI.

New sculpture

MSRI unveiled its first sculpture, "The Eightfold Way" by Helaman Ferguson, on November 14. The sculpture is a depiction of the Klein quartic, a famous object of mathematical study for more than a century. The abstract surface is a 3-holed torus that incredibly has a group of symmetries of order 336. This group cannot act isometrically in 3-space. The sculpture shows the symmetry topologically, using a pattern of twenty-four heptagons. Abstractly, each heptagon is equivalent to each other heptagon and each heptagon can be rotated and reflected on itself in fourteen ways. The sculpture is made of white marble, and it rests on a 7-sided black column that rises out of a model of the hyperbolic plane, tiled by regular heptagons meeting three to a vertex. The surface itself is a quotient space of the hyperbolic plane by a subgroup of index 336 in the group of isometries that preserves the heptagonal tiling.

The sculpture makes a beautiful centerpiece for our newly remodeled patio, which now serves as much-needed expansion space during our crowded

periods (particularly workshops) and an inspiring spot to contemplate mathematics.

Workshop on Combinatorial Games

This summer MSRI will host a special 2-week workshop on Combinatorial Games from July 11–21, 1994.

The mathematical study of 2-player perfect-information games seeks precise, provable assertions about various positions and strategies—rather than heuristics—which hope to be good enough to compete with strong human players in real time. Conway's theory of partisan games has provided a framework for analyzing games whose positions split into disjoint sums. This theory and its variations have been very successful in analyzing intricate endgame problems in a wide range of games, including such popular games as Go and Dots-and-Boxes as well as a much longer list of *mathematical* games such as Domineering and Hackenbush. Combinatorial game theory now encompasses a substantial collection of general theorems, constructive algorithms, complexity proofs, and extensive databases of endgame solutions for classical games such as chess. Engineers are also beginning to show some interest in this subject because the problem of decomposing a game position into simpler games can be somewhat analogous to the problem of decomposing a large hardware-software system into tractable modules.

The organizing committee for the workshop consists of E. Berlekamp (chair), J. Conway, N. Elkies, A. Fraenkel, R. Guy, R. Nowakowski, J. Propp, and K. Thompson.

For more information write to Combinatorial Games Workshop, MSRI, 1000 Centennial Drive, Berkeley, CA 94720; or combinatorial_games@msri.org.

Park City/IAS Mathematics Institute

The Park City/Institute for Advanced Study Mathematics Institute, formerly known as the Regional Geometry Institute, incorporates learning, teaching, and research activities in a unique, four-level integrated format. Participants include high school teachers, undergraduates,

graduate students, and postdoctoral and senior researchers.

This year's three-week institute will be held in Park City, Utah, July 10–30, 1993 (contingent upon funding from the National Science Foundation). High school teachers, in partnership with university mathematicians and students, will explore the evolution of classical geometry to modern geometry on curved spaces and will discuss issues of education reform. Undergraduate and graduate students will be offered an intense yet accessible introduction to areas of current research and application. The Research and Graduate Summer School topic is "Gauge Theory and the Topology of Four-Manifolds".

The deadline to apply to participate in the Institute is **March 1, 1994**. For further information and application forms contact: PC/IAS Mathematics Institute, 18C DeTrobriand Street, Salt Lake City, UT 84113; telephone: 801-585-3488; fax: 801-585-5793; electronic mail: pcmi@math.utah.edu.

Student Paper Competition

The Society for Industrial and Applied Mathematics (SIAM) is sponsoring a program of awards for outstanding student papers. The authors of the three best papers will each receive an award of \$750, and their registration fees will be waived for the SIAM Annual Meeting in San Diego, July 25–29, 1994. Winners must present their papers at the meeting.

Papers must be singly authored and not previously published or submitted for publication. To qualify, authors must be students in good standing who have not yet received their doctorates at the time of submission.

Submissions, which must be in English, can be sent by regular mail or fax. Each submission must include (1) an extended abstract *not longer than five pages* (including bibliography); (2) the complete paper, which will be used solely for clarification of any questions; (3) a statement by the student's faculty advisor that the paper has been prepared by the author indicated and that the author is a student in good standing; (4) a letter by the student's faculty advisor describing and evaluating the paper's

contribution; and (5) a short biography of the student. Submissions will be judged on originality, significance, and quality of exposition.

Submissions must reach SIAM on or before **March 15, 1994**. The winners will be notified by June 1, 1994. For more information contact: Allison Bogardo, SIAM, 3600 University City Science Center, Philadelphia, PA 19104-2688; tel.: 215-382-9800; fax: 215-386-7999; e-mail: bogardo@siam.org.

Graph Theory Newsletter

The *Graph Theory Newsletter (GTNL)*, published since 1971 at Western Michigan University, is now being published by the Department of Mathematics of B. V. Bhoomaraddi College in Bidar, Karnataka, India. The newsletter has several purposes: to help researchers locate publications in graph theory; to allow authors to publish abstracts of recent research; to pose unsolved problems and conjectures; and to announce newly conferred degrees, upcoming conferences, new publications, and changes of address.

For further information write to: D. G. Akka, Editor, *GTNL*, Rampure Colony, BIDAR-585403, Karnataka, India.

New Journal from Academia Sinica

The Institute of Mathematics of the Academia Sinica in the People's Republic of China has launched a new journal entitled *Algebra Colloquium*. The first issue will appear in March 1994. The aim of the journal is to introduce the latest developments in algebra and to promote international scholarly exchanges. The journal will publish research articles in pure and applied algebra.

The Editorial Board for *Algebra Colloquium* includes B. H. Neumann, S. Amitsur, A. Bak, P. M. Cohn, Paul Fong, Y. Fong, P. Hilton, N. D. Gupta, J. I. Lepowsky, M. L. Liu, M. Nagata, I. R. Shafarevich, K. P. Shum, and H. F. Tuan. For further information write to the Managing Editor, Fu-an Li, Institute of Mathematics, Chinese Academy of Sciences, Beijing 100080, China.

**Mathematics Awareness Week
"Mathematics and Medicine"
April 24–30, 1994**

Mark your calendars now and plan to observe Mathematics Awareness Week (MAW) in your area, institution, or organization. With the theme of "Mathematics and Medicine", MAW provides an excellent opportunity to celebrate the beauty and power of the mathematical sciences. Please do your part to promote public awareness of mathematics from Sunday, April 24, to Saturday, April 30, 1994. Look for further information from the Joint Policy Board for Mathematics, national sponsor of Mathematics

Awareness Week, in future issues of the *Notices*.

Erratum

Two recent articles in the *Notices* referred to the conjecture that all elliptic curves over \mathbb{Q} are modular as the "Taniyama Conjecture". The attribution of this conjecture has been the subject of debate within the mathematical community. Some believe that the name "Taniyama-Shimura Conjecture", or sometimes "Taniyama-Shimura-Weil Conjecture", more accurately reflects the history of the conjecture.

In his article "Wiles Proves Tani-

yama's Conjecture; Fermat's Last Theorem Follows" (*Notices*, July/August 1993), Kenneth Ribet chose the name "Taniyama Conjecture" for economy of expression, but now regrets his decision. He believes it would have been preferable to use the term "Taniyama-Shimura Conjecture", as that has become the standard name for it. In addition, the October 1993 issue of the *Notices* carried an article entitled "Fermat Fest Draws a Crowd", which also referred to the conjecture as the "Taniyama Conjecture". This article also should have used the standard name, "Taniyama-Shimura Conjecture".

Topology and Its Applications

S. P. Novikov, Editor

This book contains the proceedings of an international topology conference held in the town of Zagulba, near Baku in the former Soviet Union, in October 1987. Sponsored by the Institute of Mathematics and Mechanics of Azerbaijan and the Steklov Mathematical Institute, the conference was organized by F. G. Maksudov and S. P. Novikov. About 400 mathematicians, including about 100 foreigners, attended the conference. This book covers aspects of general, algebraic, and low-dimensional topology.

1991 *Mathematics Subject Classification*: 58, 55, 57, 54

ISBN 0-8218-3151-8, 250 pages (softcover), November 1993

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Funding Information for the Mathematical Sciences

NSF-CBMS Regional Conference Series

The National Science Foundation (NSF), with the sponsorship of the Conference Board of the Mathematical Sciences (CBMS), intends to support six NSF-CBMS Regional Conferences in 1995.

Each five-day conference features a distinguished lecturer who delivers ten lectures on a topic of important current research in one sharply focused area of the mathematical sciences. The lecturer subsequently prepares an expository monograph based on the lectures to be published by the AMS, the Society for Industrial and Applied Mathematics, or jointly by the American Statistical Association and the Institute for Mathematical Statistics.

One of the purposes of the program is to stimulate local research activity in each regional conference area. Participants include not only established researchers but also newcomers to the field, such as interested faculty and graduate students from nearby institutions.

Colleges or universities with at least some research competence in the field of the proposal are eligible to apply. Since a major goal of these conferences is to attract new researchers to the research area and to stimulate new research activity, institutions interested in upgrading or improving their research efforts are especially encouraged to apply.

Support is provided for about thirty participants at each conference, and the conference organizer invites both established researchers and interested newcomers, including postdoctoral researchers, graduate students, and members of underrepresented groups. Participants are provided with lodging and

meals and some travel support but do not receive stipends. CBMS pays the lecturer a stipend of \$2000 for the delivery of the lectures and an additional stipend of \$3000 when the lecturer completes the manuscript.

Conferences proposed for 1995 should normally be scheduled to occur sometime after the end of classes in May 1995 and before the beginning of classes in September 1995 but may also be scheduled during December 1995 or January 1996, when most colleges and universities are in recess.

The NSF-CBMS Regional Conferences for 1994 may be found in the December 1993 issue of the *Notices*, page 1370.

Proposals, which are submitted to the NSF, must be received by **April 4, 1994**. For further information on how to submit proposals contact: Conference Board of the Mathematical Sciences, 1529 Eighteenth Street, NW, Washington, DC 20036; telephone: 202-293-1170.

NSF Programs for Girls and Women

The National Science Foundation has a number of programs designed to promote the participation of girls and women in science, mathematics, and engineering. These programs are coordinated by the Directorate for Education and Human Resources (EHR).

Model Projects for Women and Girls are designed to produce significant and immediate changes. These projects focus on critical stages which can facilitate or hinder the successful participation of women and girls in science, mathematics, and engineering. The program has

two major goals: to encourage the design and implementation of innovative, short-term activities and to demonstrate the effectiveness of existing activities through evaluation, refinement, expansion, or replication to a different population or setting. There is a yearly deadline of **January 15**.

Experimental Projects for Women and Girls are intended to produce long-term infrastructure changes through comprehensive projects bringing permanent results. The program has two major goals: to create positive and permanent changes in academic, social, and scientific climates to stimulate the interest and develop the aptitude of girls and women in science, engineering, and mathematics and to add to knowledge about interactions between gender and the infrastructure of science, mathematics, and engineering that can provide directions for future efforts. There is a yearly target date of **May 15** for informal preliminary proposals and a yearly deadline of **September 1** for formal proposals.

Information Dissemination Activities are designed to provide mechanisms for interactions among individuals to disseminate successful strategies for encouraging participation of women and girls in science, mathematics, and engineering. The program also supports dissemination of information about the interest, retention, and advancement of women and girls in these areas to teachers, faculty, administrators and/or the general public. There is no deadline, but informal preliminary proposals must be submitted at least twelve months prior to the planned date of a conference or activity.

In addition, existing programs in EHR offer significant opportunities for projects to improve the participation of females in science, mathematics, and engineering.

The program announcement "EHR Activities for Women and Girls in Science, Engineering, and Mathematics" contains more information about these programs. These announcements may be obtained from: Education and Human Resources, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230. Program announcements may also be requested by sending electronic mail to pubs@nsf.gov (Internet) or pubs@nsf (Bitnet); request publication number 93-126 and be sure to include the title of the program announcement, your name, your complete mailing address, and the number of copies you need.

Programs of the Humboldt Foundation

The Alexander von Humboldt Foundation has a number of programs designed to promote international scientific exchanges. Between 1953 and 1990, nearly 14,000 scholars from 100 nations were sponsored by the Humboldt Foundation.

Humboldt Research Fellowships for Foreign Scholars are granted annually to up to 600 researchers who have doctorates and who are under the age of forty,

enabling them to carry out research at institutes in Germany. Applications may be submitted at any time by scholars from any nation and in any academic discipline. The fellowships initially run six to twelve months, and extensions of up to twenty-four months may be granted. Up to four months of this period may be spent at research institutes in other European countries.

Feodor Lynen Research Fellowships are granted annually to German scholars, who have doctorates and who are at most thirty-eight years old, to carry out research at institutes of former Humboldt guest researchers abroad. Applications may be made at any time for all disciplines and countries. The sponsorship period is for one to three years. Each applicant must secure a formal invitation from a former Humboldt fellow or award winner and have a specific research plan and a good command of English or the language of the host country.

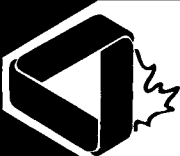
Bundeskanzler Scholarships for Future American Leaders are awarded annually to ten eminent young Americans to spend a year in Germany in academic or other public institutions. The aim is to maintain and foster the close relationship between the U.S. and Germany by sponsoring individuals who could play a pivotal role in the future of this relationship. Applications are reviewed in February each year and must be received by **October 31** of the preceding year.

An applicant should be nominated by the dean of students or another eminent person in his or her field, must be under thirty years of age, and should have at least a B.A. degree. Graduates, post-graduates, and young professionals are eligible. The program includes language classes, which begin in Germany in August, and the stay ends mid-September of the following year.

The Humboldt Foundation also sponsors Research Awards that enable prominent scholars in the natural sciences to spend four to twelve months carrying out research in Germany. For these awards, nominations must be made by eminent German scholars; direct applications are not accepted.

The Foundation maintains contact with the scholars it supports by inviting them to spend further short periods doing research in Germany, by donating academic literature and scientific equipment (in the U.S. this applies only to exceptional cases), and by awarding grants toward printing costs and toward the cost of attending academic conferences in Germany.

For more information and applications contact: Dr. Jan Keppler, Alexander von Humboldt Foundation, North American Office, 1350 Connecticut Avenue, NW, Suite 390, Washington, DC 20036; tel.: 202-296-2990; fax: 202-833-8514; electronic mail: humboldt@umail.umd.edu.



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Conference Proceedings, Canadian Mathematical Society

Representations of Algebras

Vlastimil Dlab and Helmut Lenzen, *Editors*

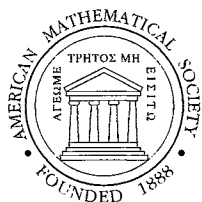
The Sixth International Conference on Representations of Algebras was held at Carleton University in Ottawa, Canada, in August 1992. This refereed volume contains papers presented at the conference, as well as papers submitted after the conference. Describing developments at the forefront of the field, this book will interest algebraists working in the field of representation theory.

1991 *Mathematics Subject Classification*: 16; 20
ISBN 0-8218-6019-4, 478 pages (softcover), December 1993
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CALL FOR SUGGESTIONS



There will be a number of contested seats in the 1994 AMS elections.
Your suggestions are wanted by

THE NOMINATING COMMITTEE

for vice-president, trustee, and five
members-at-large of the council
and by

THE PRESIDENT

for three Nominating Committee members and two
Editorial Boards Committee members.

In Addition

THE EDITORIAL BOARDS COMMITTEE

requests suggestions for appointments to various editorial boards
of Society publications.

Send your suggestions for any of the above to:

Robert M. Fossum, Secretary
American Mathematical Society
Department of Mathematics
University of Illinois
1409 West Green Street
Urbana, Illinois 61801
e-mail: r-fossum@uiuc.edu

1994 AMS Election

Nominations by Petition

Vice-President or Member-at-Large

One position of vice-president and member of the Council *ex officio* for a term of three years is to be filled in the election of 1994. The Council intends to nominate at least two candidates, among whom may be candidates nominated by petition as described in the rules and procedures.

Five positions of member-at-large of the Council for a term of three years are to be filled in the same election. The Council intends to nominate at least ten candidates, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

Petitions are presented to the Council, which, according to Section 2 of Article VII of the bylaws, makes the nominations. The Council of 23 January 1979 stated the intent of the Council of nominating all persons on whose behalf there were valid petitions.

Prior to presentation to the Council, petitions in support of a candidate for the position of vice-president or of member-at-large of the Council must have at least fifty valid signatures and must conform to several rules and operational considerations, which are described below.

Editorial Boards Committee

Two places on the Editorial Boards Committee will be filled by election. There will be four continuing members of the Editorial Boards Committee.

The President will name at least four candidates for these two places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Nominating Committee

Three places on the Nominating Committee will be filled by election. There will be six continuing members of the Nominating Committee.

The President will name at least six candidates for these three places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Rules and Procedures

Use separate copies of the form for each candidate for vice-president, member-at-large, or member of the Nominating and Editorial Boards Committees.

1. To be considered, petitions must be addressed to Robert M. Fossum, Secretary, P. O. Box 6248, Providence, Rhode Island 02940, and must arrive by 28 February 1994.

2. The name of the candidate must be given as it appears in the *Combined Membership List (CML)*. If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of the *Notices*. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate's mailing label or the Providence office.

3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.

4. On the next page is a sample form for petitions. Copies may be obtained from the secretary; however, petitioners may make and use photocopies or reasonable facsimiles.

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the *Combined Membership List* and the mailing lists. No attempt will be made to match variants of names with the form of name in the *CML*. A name neither in the *CML* nor on the mailing lists is not that of a member. (Example: The name Robert M. Fossum is that of a member. The name R. Fossum appears not to be.)

7. When a petition meeting these various requirements appears, the secretary will ask the candidate to indicate willingness to be included on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving consent.

NOMINATION PETITION FOR 1994 ELECTION

The undersigned members of the American Mathematical Society propose the name of

as a candidate for the position of (check one):

- ☐ **Vice-President**
- ☐ **Member-at-Large of the Council**
- ☐ **Member of the Nominating Committee**
- ☐ **Member of the Editorial Boards Committee**

of the American Mathematical Society for a term beginning 1 February, 1995.

Name and Address (printed or typed)

Signature

Signature

Signature

Signature

Signature

Signature

University of Kentucky, Lexington, Kentucky

March 18–19, 1994

First Announcement

The eight hundred and ninetieth meeting of the American Mathematical Society (AMS) will be held at the University of Kentucky, Lexington, Kentucky, on Friday and Saturday, March 18–19, 1994.

Invited Addresses

Jack Dongarra, Oak Ridge National Laboratory and University of Tennessee, *Recent work in parallel algorithms for linear algebra*.

David R. Morrison, Institute for Advanced Study, *Mirror symmetry and the quantum moduli space of Calabi-Yau manifolds*.

James E. McClure, Purdue University, *Applications of Hochschild and Andre-Quillen homology to homotopy theory*.

George F. McNulty, University of South Carolina, *Avoiding combinatorial patterns in strings of symbols*.

Special Sessions

Infinite groups and group rings, **James C. Beidleman** and **Donald B. Coleman**, University of Kentucky.

Geometric group theory and metric geometry, **Philip L. Bowers**, Florida State University.

Partial differential equations and minimal smoothness conditions, **Russell M. Brown** and **John L. Lewis**, University of Kentucky, and **Zhongwei Shen**, Purdue University.

Graph theory, **Karen L. Collins**, Wesleyan University, and **Ewa M. Kubicka**, University of Louisville.

Collaborative learning in calculus and precalculus, **Michael B. Freeman**, University of Kentucky.

Inverse spectral problems: theory and computation, **Peter D. Hislop** and **Peter Perry**, University of Kentucky.

Homotopy theory, **Mark A. Hovey**, University of Kentucky, and **James E. McClure**.

Combinatorics of words and equations in algebra, logic, and computer science, **George F. McNulty**.

Quantum algebraic geometry, **David R. Morrison**, Institute for Advanced Study.

Elliptic genera and elliptic cohomology, **Serge Ochanine**, University of Kentucky.

Large-scale matrix computations with applications, **Charles H. Romine**, Oak Ridge National Laboratory.

Mathematics of many-body quantum theory, **M. Beth Ruskai**, University of Massachusetts at Lowell.

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. Unfortunately, late papers cannot be accommodated.

Accommodations

Rooms have been blocked in the following hotels. An NCAA Regional Men's Basketball Tournament is scheduled in Lexington for the weekend of March 18, so participants are advised to make reservations early. Participants should make their own arrangements with the hotel of their choice. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

Campbell House: 1375 Harrodsburg Road, Lexington, KY 40504. Telephone: 606-255-4281. Single \$55 and Double \$60. **Deadline for reservations is March 3, 1994.**

Hyatt Regency Lexington: 400 West Vine Street, Lexington, KY 40507. Telephone: 606-253-1234. Single or Double \$78. **Deadline for reservations is February 24, 1994.**

Kentucky Inn: 525 Waller Avenue, Lexington, KY 40504. Telephone: 800-221-6652 or 606-254-1177. Single \$30 and Double \$40. **Deadline for reservations is March 3, 1994.**

Springs Inn: 2020 Harrodsburg Road, Lexington, KY 40503. Telephone: 800-354-9503 or 606-277-5751. Single \$35 and Double \$44. **Deadline for reservations is February 17, 1994.**

Registration

The meeting registration desk will be located in the main foyer on the ground floor of the Business and Economics Building, which is near the main gate on South Limestone Street, and will be open from 7:30 a.m. to 5:00 p.m. on Friday, March 18, and 7:30 a.m. to noon on Saturday, March 19. The registration fees are \$30 for members of the AMS, \$45 for nonmembers, and \$10 for emeritus members, students, or unemployed mathematicians.

Travel

Delta has been selected as the official airline for this meeting. The following benefits are available exclusively to mathematicians and their families attending the meeting: a savings of up to 10% off any published domestic fare (includes U.S., Canada, Bermuda, the Bahamas, Puerto Rico, and the U.S. Virgin Islands), subject to applicable fare restrictions, is available. Seats are limited. Call 1-800-241-6760 between 8:00 a.m. and 11:00 p.m. EST to contact Delta directly or call any licensed travel agent. Instruct the ticket agent to refer to file **MO456** in order to qualify for the applicable discount.

Kansas State University, Manhattan, Kansas

March 25–26, 1994

First Announcement

The eight hundred and ninety-first meeting of the American Mathematical Society will be held at Kansas State University in Manhattan, Kansas, on Friday, March 25, and Saturday, March 26, 1994. All sessions will be held in Cardwell Hall and Waters Hall.

Invited Addresses

Marilyn Breen, University of Oklahoma, *Krasnosel'skii-type theorems in orthogonal polygons*.

Michael C. Cranston, University of Rochester, *On coupling in applications of probability to analysis*.

David M. Goss, Ohio State University, *Zeta functions of characteristic p arithmetic*.

Mei-Chi Shaw, University of Notre Dame, *Solvability and estimates for the tangential Cauchy-Riemann operators*.

Special Sessions

Harmonic analysis and probability, **Andrew G. Bennett** and **Charles N. Moore**, Kansas State University.

Groups and geometries, **Andrew L. Chermak** and **Albert L. Delgado**, Kansas State University.

Quantum topology, **Louis Crane** and **David Yetter**, Kansas State University.

Global fields, **David M. Goss**, Ohio State University; **Michael I. Rosen**, Brown University; and **Dinesh Thaker**, University of Arizona.

Special functions, **Robert A. Gustafson**, Texas A&M University.

Several complex variables and partial differential equations, **A. Alexandrou Himonas**, Institute of Advanced Study, and **Mei-Chi Shaw**.

Nonlinear topics and critical phenomena in partial differential equations, **Lev Kapitanski**, Brown University, and **Lige Li**, Kansas State University.

Representations of algebraic groups and quantum groups, **Zongzhu Lin** and **David B. Surowski**, Kansas State University.

Operator theory, **Gabriel Nagy**, Kansas State University, and **Vladimir V. Peller**, University of Hawaii.

Convergence problems in ergodic theory, **Joseph M. Rosenblatt**, Ohio State University.

Dynamical systems and fluid dynamics, **Misha Vishik**, University of Texas at Austin.

Computational mathematics and numerical analysis, **Hunan Yang** and **Qisu Zou**, Kansas 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. This deadline has also expired.

Accommodations

Rooms have been blocked for participants at the Ramada Inn, Best Western Continental Inn, and Days Inn. Participants should make their own arrangements directly with the hotel of their choice and request the AMS conference rate to obtain the rate listed. **All rooms will be on a space-available basis after March 8, 1994.**

Ramada Inn (0.2 mile to Cardwell Hall): 17th and Anderson Avenue, Manhattan, KS 66502. Telephone: 913-539-7531. Single \$57 and Double \$63. The Ramada Inn is next to the San Bernardino Freeway (Interstate 10). The Ramada will furnish complimentary shuttle service to the campus and complimentary continental breakfast.

Best Western (1.2 miles to Cardwell Hall): 100 Bluemont Avenue, Manhattan, KS 66502. Telephone: 800-452-5111 or 913-776-4771. Single or Double \$54 (\$4 each additional person).

Days Inn (1.7 miles to Cardwell Hall): 1501 Tuttle Creek Boulevard, Manhattan, KS 66502. Telephone: 800-325-2525 or 913-539-5391. Rooms are \$50 (2 double beds, 1–4 people).

Other hotels/motels in the area are the Holiday Inn (1.8 miles to Cardwell Hall), tel: 913-539-5311; Super 8 Motel (1.6 miles to Cardwell Hall), tel: 913-537-8468 or (800) 800-8000; and Motel 6 (1.3 mile to Cardwell Hall), tel: 913-537-1022.

Registration

The registration desk will be located inside the main entrance to Cardwell Hall and will be open from 8:00 a.m. to 5:00 p.m. on Friday, March 25, and from 8:00 a.m. to noon on Saturday, March 26. The registration fees are \$30 for members of the AMS, \$45 for nonmembers, and \$10 for emeritus members, students, or unemployed mathematicians.

Social Events

A cash bar reception will be held on Friday evening from 8:00 p.m. to 11:00 p.m. at the Ramada Inn located just south of the Kansas State campus.

Travel

USAir is the official airline for this meeting. The following benefits are available exclusively to mathematicians and their families attending the meeting: 10% discount off any published domestic fare with a seven-day advance purchase. Call USAir's Meetings and Convention Reservation Office at 1-800-334-8644 between 8:00 a.m. and 9:00 p.m. EST or call any licensed travel agent. Instruct the agent to refer to gold file #16950015 in order to qualify for the applicable discount.

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. Invited addresses at Sectional Meetings are selected by the Section Program Committee, usually twelve to eighteen months in advance of a meeting. Members wishing to nominate candidates for invited addresses should send relevant information to the associate secretary for the section who will forward it to the Section Program Committee.

Brooklyn, NY, April 1994

David Bayer	Debasis Mitra
Peter B. Kronheimer	Nicholai Reshetikhin

Eugene, OR, June 1994

Stephen A. Mitchell	Gustavo A. Ponce
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Minneapolis, MN, August 1994

Todd J. Arbogast (AMS-MAA)	Carole B. Lacampagne (AMS-MAA)
Cameron Gordon (AMS-MAA)	Pierre Louis Lions (Progress Lecturer)

Stillwater, OK, October 1994

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

Richmond, VA, November 1994

Loren D. Pitt	Doron Zeilberger
Cora S. Sadosky	

Hartford, CT, March 1995

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

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.

April 1994 Meeting in Brooklyn, New York

Eastern Section

Associate Secretary: Lesley M. Sibner

Deadline for organizers: Expired

Deadline for consideration: Expired

Boris Aronov, *Computational geometry*
 Craig J. Benham, *Mathematical problems in molecular biology*
 Joan S. Birman, Sylvain E. Cappell, and Edward Y. Miller,
Invariants of low dimensional manifolds
 Jozef Dodziuk and Edgar A. Feldman, *Geometric analysis*
 Benjamin Fine, Anthony M. Gaglione, and Kathryn Kuiken,
Combinatorial group theory and related topics
 Frederick P. Gardiner and Yunping Jiang, *Teichmüller theory
 and dynamical systems*
 Dorian Goldfeld, *Analytic number theory*
 Jacob E. Goodman and Erwin Lutwak, *Geometric convexity*
 Pao-sheng Hsu and L. Narisi, *Topological methods; topologi-
 cal measure theory*
 Yanyan Li, *Partial differential equations*
 Janos Pach and William Steiger, *Discrete geometry*
 Robert J. Sibner, *Gauge theory and applications*
 Alan A. Weiss, *Models in telecommunications*

June 1994 Meeting in Eugene, Oregon

Western Section

Associate Secretary: Lance W. Small

Deadline for organizers: Expired

Deadline for consideration: March 14, 1994

Frank W. Anderson and Kent R. Fuller, *Rings and their
 representations*
 Steven A. Bleiler, *3-manifolds*
 Frank R. Demeyer and Thomas M. McKenzie, *Commutative
 algebra and probability groups*
 Paul G. Goerss and Stephen A. Mitchell, *Algebraic K-theory
 and homotopy*
 Chris Phillips, *Simple C^* -algebras*
 Robby Robson, *Undergraduate research*

August 1994 Meeting in Minneapolis, Minnesota

Associate Secretary: Lesley M. Sibner

Deadline for organizers: Expired

Deadline for consideration: April 26, 1994

October 1994 Meeting in Stillwater, Oklahoma

Central Section

Associate Secretary: Andy R. Magid

Deadline for organizers: January 28, 1994

Deadline for consideration: July 13, 1994

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

Edward T. Cline, *Representations of algebraic groups*
 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*
 Benny D. Evans, *The evolving undergraduate mathematics curriculum*
 Vladimir Ezhov and Alan V. Noell, *Several complex variables*
 Jerry A. Johnson, *Technology in the classroom*

November 1994 Meeting in Richmond, Virginia

Southeastern Section
 Associate Secretary: Robert J. Daverman
 Deadline for organizers: February 11, 1994
 Deadline for consideration: July 13, 1994

Paul S. Bourdon and William T. Ross, *Operator on Banach spaces of analytic functions*

January 1995 Meeting in San Francisco, California

Associate Secretary: Andy R. Magid
 Deadline for organizers: April 2, 1994
 Deadline for consideration: September 9, 1994

March 1995 Meeting in Hartford, Connecticut

Eastern Section
 Associate Secretary: Lesley M. Sibner
 Deadline for organizers: June 3, 1994
 Deadline for consideration: To be announced

March 1995 Meeting in Orlando, Florida

Southeastern Section
 Associate Secretary: Robert J. Daverman
 Deadline for organizers: June 17, 1994
 Deadline for consideration: To be announced

Robert C. Brigham and Richard P. Vitray, *Combinatorics and graph theory*

John R. Cannon, *Inverse and ill-posed problems*

S. Roy Choudhury, *Nonlinear dynamical systems, chaos, and turbulence*

S. Roy Choudhury and Lokenath Debnath, *Solitons and nonlinear waves*

Xin Li and Ram N. Mohapatra, *Approximation theory and special functions*

Piotr Mikusinski, *New trends in generalized functions*

Ahmed I. Zayed, *Sampling theory, wavelets, and signal processing*

March 1995 Meeting in Chicago, Illinois

Central Section
 Associate Secretary: Andy R. Magid
 Deadline for organizers: June 24, 1994
 Deadline for consideration: To be announced

November 1995 Meeting in Kent, Ohio

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

January 1996 Meeting in Orlando, Florida

Associate Secretary: Lance W. Small
 Deadline for organizers: April 12, 1995
 Deadline for consideration: To be announced

March 1996 Meeting in Iowa City, Iowa

Central Section
 Associate Secretary: Andy R. Magid
 Deadline for organizers: June 22, 1995
 Deadline for consideration: To be announced

Daniel D. Anderson, *Commutative ring theory*

April 1996 Meeting in Baton Rouge, Louisiana

Southeastern Section
 Associate Secretary: Robert J. Daverman
 Deadline for organizers: July 19, 1995
 Deadline for consideration: To be announced

January 1997 Meeting in San Diego, California

Associate Secretary: Lesley M. Sibner
 Deadline for organizers: April 8, 1996
 Deadline for consideration: To be announced

Information for Organizers

Special sessions at Annual and Summer Meetings are held under the supervision of the Program Committee for National Meetings (PCNM). They are administered by the associate secretary in charge of that meeting with staff assistance from the meetings department in the Society office in Providence.

Special sessions are selected by the PCNM from a list of proposed special sessions in essentially the same manner as individuals are selected to give invited addresses. The number of special sessions at a Summer or Annual Meeting is limited. Precise details concerning proposals for and organization of special sessions are contained in the "Rules for Special Sessions", available upon request from the meetings department or any associate secretary.

Each person selected to give an invited address is invited to generate a special session, either by personally organizing one or by having a session organized by others. Proposals to organize a special session are sometimes requested either by the PCNM or by the associate secretary. Other proposals should be submitted to the associate secretary in charge of that meeting (who is an *ex officio* member of the committee). These proposals must be in the hands of the PCNM at least nine months prior to the meeting at which the special session is to be held in order that the committee may consider all the proposals for special sessions simultaneously.

It should be noted that special sessions must be announced in the *Notices* in such a timely fashion that any Society member who so wishes may submit an abstract for consideration for presentation in the special session. The consideration deadline is usually three weeks before the usual deadline for abstracts for the meeting.

The processing of proposals for special sessions for Sectional Meetings is handled in essentially the same manner as for Annual and Summer Meetings by the Section Program Committee. Again, no special session at a Sectional Meeting

may be approved so late that its announcement appears past the deadline after which members can no longer send abstracts for consideration for presentation in that special session.

The Society reserves the right of first refusal for the publication of proceedings of any special session. These proceedings appear in the book series *Contemporary Mathematics*.

Western Section

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Telephone: 615-974-6577

As a general rule, members who anticipate organizing special sessions at AMS meetings are advised to seek approval at least nine months prior to the scheduled date of the meeting.

Information for Speakers

A great many of the papers presented in special sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a special session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting. Contributors should know that there is a limitation in size of a single special session, so that it is sometimes true that all places are filled by invitation.

Papers submitted for consideration for inclusion in special sessions but not accepted will receive consideration for a ten-minute contributed paper session, unless specific instructions to the contrary are given. Contributed papers will be grouped by related *Mathematical Reviews* subject classifications into sessions, insofar as possible. The title of each paper accepted and the time of presentation will be listed in the program of the meeting.

Abstracts of papers submitted for consideration for presentation at a special session must be received by the Providence

office (Abstracts Coordinator, AMS Meetings Department, P.O. Box 6887, Providence, RI 02940) by the special deadline for special sessions, which is usually three weeks earlier than the deadline for contributed papers for the same meeting. The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Electronic submission of abstracts is available to those who use the \TeX typesetting system. The electronic package of files may be requested from e-MATH via e-mail by following this procedure:

1. Type telnet e-math@math.ams.org.
2. When asked for login, type e-math.
3. When asked for password, type e-math.
4. Type Q to bypass welcome information and go directly to the Main Menu.
5. In the Main Menu, select #12 for Gopher.
6. In Gopher, select #11 for Meetings and Conferences.
7. In Meetings and Conferences, select #3 for Abstracts and follow the instructions for 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 , $\text{\AA}\text{\AA}\text{\S}\text{\TeX}$, or the $\text{\K}\text{\TeX}$ package. Requests for general information concerning abstracts may be sent to abs-misc@math.ams.org.

Number of Papers Presented

Joint Authorship

Although an individual may present only one ten-minute contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once. An author can speak by invitation in more than one special session at the same meeting.

An individual may contribute only one abstract by title in any one issue of *Abstracts*, but joint authors are treated as a separate category. Thus, in addition to abstracts from two individual authors, one joint abstract by them may also be accepted for an issue.

Site Selection for Sectional Meetings

Sectional Meeting sites are recommended by the associate secretary for the Section and approved by the Secretariat. Recommendations are usually made eighteen to twenty-four months in advance. Host departments supply local information, ten to twelve rooms with overhead projectors for contributed paper sessions and special sessions, an auditorium with twin overhead projectors for invited addresses, and registration clerks. The Society partially reimburses for the rental of facilities and equipment, and for staffing the registration desk. Most host departments volunteer; to do so, or for more information, contact the associate secretary for the Section.

Joint Summer Research Conferences in the Mathematical Sciences

Mount Holyoke College, South Hadley, Massachusetts, June 11 to July 15, 1994

The 1994 Joint Summer Research Conferences in the Mathematical Sciences will be held at Mount Holyoke College, South Hadley, Massachusetts, from June 11 to July 15. It is anticipated that the series of conferences will be supported by grants from the National Science Foundation and other agencies.

There will be six conferences in six different areas of mathematics. The topics and organizers for the conferences were selected by the AMS, the Institute of Mathematical Statistics (IMS), and the Society for Industrial and Applied Mathematics (SIAM) Committee on Joint Summer Research Conferences in the Mathematical Sciences. The selections were based on suggestions made by the members of the committee and individuals submitting proposals. The committee considered it important that the conferences represent diverse areas of mathematical activity, with emphasis on areas currently especially active, and paid careful attention to subjects in which there is important interdisciplinary activity at present.

The Joint Summer Research Conferences are intended to complement the Society's program of annual Summer Institutes and Summer Seminars, which have a larger attendance and are substantially broader in scope. The conferences are research conferences and are not intended to provide an entree to a field in which a participant has not already worked.

It is expected that funding will be available for a limited number of participants in each conference. Others, in addition to those funded, will be welcome, within the limitations of the facilities of the campus. In the spring a brochure of information will be mailed to all who are requesting to attend the conferences. The brochure will include information on room and board rates, the residence and dining hall facilities, travel, local information, and a Residence Housing Form to request on-campus accommodations. Information on off-campus housing will also be included in the brochure. Participants will be responsible for making their own housing and travel arrangements. Each participant will be required to pay a conference fee.

Those interested in attending one of the conferences should send the following information to the Summer Research Conference Coordinator, Conferences Department, American Mathematical Society, Post Office Box 6887, Providence, RI 02940; fax: 401-455-4004; e-mail: chh@math.ams.org.

Please type or print the following:

1. Title and dates of conference desired.
2. Full name.
3. Mailing address.
4. Telephone number and area code for office and home, e-mail address, fax number.
5. A short paragraph describing your scientific background relevant to the topic of the conference. Also indicate if you are a graduate or undergraduate student, or if you received your Ph.D. on or after 7/1/88.
6. Financial assistance requested; please estimate cost of travel.
7. Indicate if support is not required and if interested in attending even if support is not offered.

The deadline for receipt of requests for information is March 4, 1994. Requests to attend will be forwarded to the Organizing Committee for each conference for consideration after the deadline of March 4. All applicants will receive a formal invitation, Brochure of Information, notification of financial assistance, and a tentative scientific program (if the chair has prepared one in advance; otherwise, programs will be distributed at on-site registration) from the AMS by May 1. Funds available for these conferences are limited and individuals who can obtain support from other sources should do so. The allocation of grant funds is administered by the AMS office, and the logistical planning for the conferences is also done by the AMS. However, it is the responsibility of the chair of the Organizing Committee of each conference to determine the amount of support participants will be awarded. This decision is **not** made by the AMS. Women and minorities are encouraged to apply and participate in these conferences.

Any questions concerning the scientific portion of the conference should be directed to the chair or any member of the Organizing Committee.

The Joint Summer Research Conferences in the Mathematical Sciences are under the direction of the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. The following committee members chose the topics for the 1994 conferences: Fan R. K. Chung, Leonard Evens, Alan F. Karr, Peter W. K. Li, Bart Ng, Stewart B. Priddy, Robert J. Serfling, Michael Shub, William E. Strawderman, and Sue Whitesides.

N.B. Lectures begin on Sunday morning and run through Thursday. Check in for housing begins on Saturday. No lectures are held on Saturday.

Meetings

Please refer to the November issue of the *Notices* for complete descriptions.

Saturday, June 11, to Friday, June 17

Continuous algorithms and complexity

J. F. TRAUB (Columbia University), co-chair

J. RENEGAR (Cornell University), co-chair

Saturday, June 18, to Friday, June 24

Moonshine, the monster, and related topics

GEOFFREY MASON (University of California, Santa Cruz), chair

CHONGYING DONG (University of California, Santa Cruz), co-chair

JOHN MCKAY (Concordia University), co-chair

Saturday, June 25, to Friday, July 1

Multidimensional complex dynamics

ERIC D. BEDFORD (Indiana University), co-chair

JOHN-ERIK FORNÆSS (University of Michigan, Ann Arbor), co-chair

Saturday, June 25, to Friday, July 1

Markov chain Monte Carlo methods

ALAN GELFAND (University of Connecticut), chair

Saturday, July 2, to Friday, July 8

Periodicity and structured homology theories in homotopy theory

PAUL G. GOERSS (University of Washington), co-chair

HAL SADOFSKY (Johns Hopkins University), co-chair

PAUL L. SHICK (John Carroll University), co-chair

Saturday, July 9, to Friday, July 15

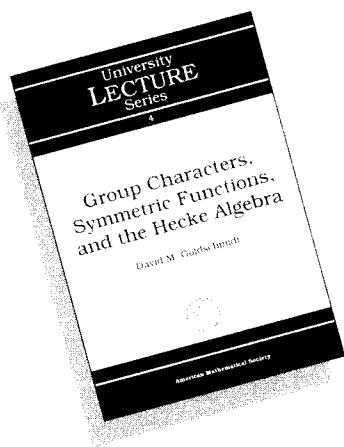
Bergman spaces and the operators that act on them

STEPHEN D. FISHER (Northwestern University), co-chair

SHELDON AXLER (Michigan State University), co-chair

PETER L. DUREN (University of Michigan), co-chair

UNIVERSITY LECTURE SERIES



Group Characters, Symmetric Functions, and the Hecke Algebra

David Goldschmidt

Volume 4

The book is made up of lecture notes from a course taught by Goldschmidt at the University of California at Berkeley in 1989. The course was organized in three parts. Part I covers, among other things, Burnside's Theorem that groups of order $p^a q^b$ are solvable, Frobenius's Theorem on the existence of Frobenius kernels, and Brauer's characterization of characters. Part II covers the classical character theory of the symmetric group and includes an algorithm for computing the character table of S^n ; a construction of the Specht modules; the "determinant form" for the irreducible characters; the hook-length formula of Frame, Robinson, and Thrall; and the Murnaghan-Nakayama formula. Part III covers the ordinary representation theory of the Hecke algebra, the construction of the two-variable Jones polynomial, and a derivation of Ocneanu's "weights" due to T. A. Springer.

1991 *Mathematics Subject Classification*: 20. 57

ISBN 0-8218-7003-3, 73 pages (softcover), June 1993

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1994 Summer Seminar in Applied Mathematics

Dynamical systems and probabilistic methods for nonlinear waves

Mathematical Sciences Research Institute, Berkeley, California, June 20–July 1

The twenty-fourth AMS-SIAM Summer Seminar in Applied Mathematics will be held June 20–July 1, 1994, at the Mathematical Sciences Research Institute in Berkeley, California. The seminar will be sponsored by the American Mathematical Society, the Mathematical Sciences Research Institute, and the Society for Industrial and Applied Mathematics. It is anticipated that the seminar will be partially supported by grants from federal agencies. The proceedings of the seminar will be published by the American Mathematical Society in the *Lectures in Applied Mathematics* series.

Nonlinear waves provide a rich source of phenomena which are important to both mathematics and science. Scientifically, these include disturbances in the atmosphere and the oceans, the propagation of laser light in nonlinear optics, and waves in plasmas and fluids. Mathematically, nonlinear wave theory has unveiled the soliton: one of the most important discoveries in nonlinear partial differential equations (pde's) during the last twenty-five years. In addition, results in nonlinear wave theory include rigorous descriptions of the scattering of localized solitary waves, detailed descriptions of the development of singularities for nonlinear pde's, a thorough understanding of dissipative and dispersive mechanisms for the regularization of these singularities, and numerical observations (with theoretical interpretation) of temporally chaotic behavior in nonlinear dissipative waves.

From a mathematical perspective, many recent results about nonlinear waves belong to a relatively new area—infinite dimensional dynamical systems theory for pde's. Soliton equations are completely integrable Hamiltonian systems in infinite dimensions. The stability and scattering of solitary waves naturally admit dynamical systems interpretations which play a central role in their resolution. The same can be said of the description of the development and behavior of singularities for nonlinear Schroedinger equations. Dynamical systems theory is central to any study of chaotic dispersive waves.

However, from a scientific perspective, these successes have been restricted to relatively simple situations involving one, a very few, or a regular array of solitary waves. To address issues of greater scientific relevance and complexity, it is likely that probabilistic methods for nonlinear pde's are required. Nonlinear waves are beginning to provide an excellent testing ground for these methods. Natural questions concern the interaction of many solitary waves (coherent structures) with each other and with a random environment which itself could be fixed or evolving.

More specifically, the organizers note recent mathematical

results in the equilibrium statistical mechanics of solitons, in the advection of a passive scalar via a random velocity field, in nonequilibrium statistical theories of both weak and strong turbulence, and in stochastic pde's such as the randomly forced Burgers and nonlinear Schroedinger equations. Controlled numerical studies are beginning to appear which investigate the coexistence of random and nonlinear effects in waves, and which test the predictions of the more heuristic turbulence theories. These theories and numerical studies directly impact our knowledge of wind-driven waves in the ocean, of chaotic and turbulent behavior in plasmas, of the long-distance propagation of laser pulses in nonlinear fibers, and of idealized models of proteins and DNA, for example.

This research area, bringing probabilistic and dynamical systems methods to bear on pde's, is very broad. Advances require that modern mathematical theories, together with computational and visualization methods, be developed and applied to appropriate and relevant scientific problems. Probabilistic and dynamical methods pose important technical problems in pde theory and unveil fascinating new phenomena. They constitute an important general area to expose to researchers who are just initiating their own programs.

The organizing committee consists of **Percy Deift**, Courant Institute for the Mathematical Sciences, New York University; **Philip Holmes** (co-chair), Cornell University; **James M. Hyman**, Los Alamos National Laboratories; **C. David Levermore**, University of Arizona; **David W. McLaughlin** (co-chair), Princeton University; **Y. Sinai**, Princeton University; and **C. Eugene Wayne**, Pennsylvania State University.

Expository series of lectures will be given by senior researchers including Peter S. Constantin, Walter L. Craig, Percy Deift, Charles Doering, Hermann Flaschka, Nancy J. Kopell, Dave Levermore, David W. McLaughlin, Alexander Mielke, Gene Wayne, and Steve Wiggins.

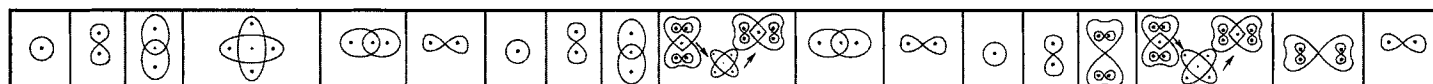
Those interested in attending the seminar should send the following information **before March 15, 1994**, to AMS-SIAM Summer Seminar Conference Coordinator, American Mathematical Society, P.O. Box 6887, Providence, R.I. 02940; e-mail: dls@math.ams.org. Please type or print the following:

1. Full name and mailing address;
2. Telephone number and area code for office and home;
3. E-mail address if available;
4. Anticipated arrival and departure dates;
5. Your scientific background relevant to the topic of the seminar; please indicate if you are a student or if you received your Ph.D. on or after 7/1/88;

6. Financial assistance requested (please estimate cost of travel); indicate if support is not required and if interested in attending even if support is not offered.

Special encouragement is extended to junior scientists to apply. A special pool of funds expected from federal agencies has been earmarked for this group. Other participants who wish

to apply for a grant-in-aid should so indicate; however, funds available for the seminar are very limited, and individuals who can obtain support from other sources should do so. Graduate students who have completed at least one year of graduate school are encouraged to participate.



American Mathematical Society Translations, Series 2

Ordered Sets and Lattices II Volume 152

This indispensable reference source contains a wealth of information on lattice theory. The book presents a survey of virtually everything published in the fields of partially ordered sets, semilattices, lattices, and Boolean algebras that was reviewed in *Referativnyi Zhurnal Matematika* from mid-1982 to the end of 1985. Of interest to mathematicians, as well as to philosophers and computer scientists in certain areas, this unique compendium is a must for any mathematical library.

1991 *Mathematics Subject Classification*: 06; 03, 08

ISBN 0-8218-7501-9, 247 pages (hardcover), November 1992

Individual member \$77, List price \$128, Institutional member \$102

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Singularity Theory and Some Problems of Functional Analysis Volume 153

S. G. Gindikin, *Editor*

The papers in this volume include reviews of established areas as well as presentations of recent results in singularity theory. The authors have paid special attention to examples and discussion of results rather than burying the ideas in formalism, notation, and technical details. The aim is to introduce all mathematicians—as well as physicists, engineers, and other consumers of singularity theory—to the world of ideas and methods in this burgeoning area.

1991 *Mathematics Subject Classification*: 40, 51, 57, 58, 92; 12, 19, 28, 32, 35, 49, 60

ISBN 0-8218-7502-7, 199 pages (hardcover), November 1992

Individual member \$61, List price \$101, Institutional member \$81

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Symposium on Quantization and Nonlinear Wave Equations

Massachusetts Institute of Technology, Cambridge, Massachusetts

June 7–11, 1994

With the support of a fund established by Dr. and Mrs. Carroll V. Newsom in honor of the memory of John von Neumann and anticipated support from the National Science Foundation, a symposium on *Quantization and nonlinear wave equations* will take place at the Massachusetts Institute of Technology, Cambridge, Massachusetts, from Tuesday through Saturday, June 7–11, 1994.

The topic was selected by the AMS Committee on Summer Institutes and Special Symposia, whose members at the time of selection were William Browder, Princeton University; Donald L. Burkholder, University of Illinois; Lawrence Craig Evans, University of California, Berkeley; Melvin Hochster, University of Michigan; Nicholas Katz, Princeton University; Brian Parshall (chair), University of Virginia; Jean-Francois Treves, Rutgers University; and Edward Witten, Institute for Advanced Study. Proceedings will be published by the American Mathematical Society.

The Organizing Committee for the symposium includes **William Arveson**, University of California, Berkeley; **Robert Blattner**, University of California, Los Angeles; **Haim Brezis**, Rutgers University and University of Paris (co-chair); **Thomas Branson**, University of Iowa; and **Irving Segal**, Massachusetts Institute of Technology (co-chair).

The symposium will review, report recent progress in, and survey possible future directions in the field of physical mathematics that was at the heart of von Neumann's motivation and some of his most seminal contributions. Session topics include the global theory of classical nonlinear wave equations and its differential geometric and general relativistic aspects; the mathematical theory of quantum fields and its algebraic and constructive aspects; operator algebra, groups of automorphisms, and new directions in quantum mechanics; and symplectic quantization and group representations.

A list of prospective speakers includes William Arveson, University of California, Berkeley; Robert Blattner, University of California, Los Angeles; Thomas Branson, University of Iowa; Haim Brezis, Rutgers University and University of Paris; Yvonne Choquet-Bruhat, University of Paris; Alain Connes, College de France and Institute des Hautes Etudes Scientifiques; Ludwig Faddeev, Steklov Mathematical Institute; Charles Fefferman, Princeton University; Jurg Frohlich, Eidgenosse Technische Hochschule; Izrail Gelfand, Rutgers University; Leonard Gross, Cornell University; Roger Howe, Yale University; Arthur Jaffe, Harvard University; Palle Jorgensen, University of Iowa; Sergiu Klainerman, Princeton University; David Kazhdan, Harvard University; Peter Lax, Courant Institute of Mathematical Sciences; Robert Power,

University of Pennsylvania; Richard Schoen, Stanford University; Irving Segal, Massachusetts Institute of Technology; Walter Strauss, Brown University; Michelle Vergne, Centre de Recherche Scientifique; Arthur Wightman, Princeton University; and Zhengfang Zhou, Michigan State University.

A list of prospective panel discussion leaders includes Victor Guillemin, Massachusetts Institute of Technology; Cathleen S. Morawetz, Courant Institute of Mathematical Sciences; P. L. Lions, University of Paris; and David Vogan, Massachusetts Institute of Technology.

One afternoon will be free of scheduled talks in order to facilitate ad hoc scientific discussions or visits to sites of general interest in the greater Boston area.

Accommodations will be in MIT dormitories located on the Charles River a short walk from the meeting area. Rooms of several sizes and types will be available, both with and without a meal plan. MIT is conveniently reached by subway or taxi from the rail terminus, South Station, or Logan Airport in a matter of minutes. MIT adjoins Kendall Square, which is well supplied with hotels and restaurants. The meeting area will be close to the Institute Science Library and nearby discussion/seminar rooms will be available.

In the spring a brochure of information will be mailed to all who are requesting to attend the symposium. The brochure will include information on room and board rates, the residence and dining hall facilities, travel, local information, and a Residence Housing Form to request on-campus accommodations. Information on off-campus housing will also be included in the brochure. Participants will be responsible for making their own housing and travel arrangements. It is expected that funding will be available for a limited number of participants. Limited support is expected to be available for graduate students. A social fee of \$15 will be required.

Those interested in attending the symposium should send the following information to the Symposium Conference Coordinator, Meetings and Conferences Department, American Mathematical Society, Post Office Box 6887, Providence, RI 02940; fax: 401-455-4004; e-mail: wsd@math.ams.org.

Please type or print the following:

1. Full name.
2. Mailing address.
3. Telephone number and area code 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. Financial assistance requested; please estimate cost of travel.

Meetings

6. Indicate if support is not required and if interested in attending even if support is not offered.
7. 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 March 1, 1994. Requests to attend will be forwarded to the Organizing Committee for consideration after the deadline of March 1. All applicants will receive a formal invitation, Brochure of Information, notification of financial assistance, and a tentative scientific program (if the co-chairs have prepared one in advance; otherwise, programs will be distributed on-site) from the AMS by May 1, 1994. 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 co-chairs 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 **Irving Segal**, MIT, Room 2-244, Cambridge, MA 02139; telephone: 617-253-4985; e-mail: ies@math.mit.edu.

TRANSLATIONS OF MATHEMATICAL MONOGRAPHS

Functions on Manifolds Algebraic and Topological Aspects

V. V. Sharko
Volume 131

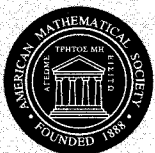
This monograph covers in a unified manner new results on smooth functions on manifolds. A major topic is Morse and Bott functions with a minimal number of singularities on manifolds of dimension greater than five. Sharko computes obstructions to deformation of one Morse function into another on a simply connected manifold. In addition, a method is developed for constructing minimal chain complexes and homotopical systems in the sense of Whitehead. This leads to conditions under which Morse functions on non-simply-connected manifolds exist. Sharko also describes new homotopical invariants of manifolds, which are used to substantially improve the Morse inequalities. The conditions guaranteeing the existence of minimal round Morse functions are discussed.

1991 *Mathematics Subject Classification*: 57, 58

ISBN 0-8218-4578-0, 193 pages (hardcover), November 1993

Individual member \$59, List price \$98, Institutional member \$78

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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)

January 1994

12-15. **Joint Mathematics Meetings**, Cincinnati, OH (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

16-22. **Gruppentheorie (Permutationsgruppen)**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 710)

17-19. **Structure and Statistical Law of Turbulence**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan.

(Jul./Aug. 1993, p. 710)

23-25. **Fifth Annual ACM-SIAM Symposium on Discrete Algorithms**, Arlington, VA. (May/Jun. 1993, p. 513)

23-29. **Singulare Integral- und Pseudo-Differential-Operatoren und Ihre Anwendungen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

24-28. **IMA Workshop on Mathematical Population Genetics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

24-28. **Complex Analysis on Hyperbolic 3-manifolds**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 711)

25-29. **Sixth Benin International Conference on Scientific Computing**, University of Benin City, Nigeria. (Sep. 1993, p. 924)

30-February 5. **Nichtstandardanalysis und Anwendungen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

February 1994

February 1994. **Workshop on Dynamical Disease**, Laurentian Mountains north of Montréal. (Jan. 1992, p. 64)

February-mid-May. **Linear Operators**, Stefan Banach International Mathematical Center, Warsaw, Poland. (Nov. 1993, p. 1253)

2-4. **IMACS Symposium on Mathematical Modelling**, Vienna, Austria. (Jul./Aug. 1993, p. 711)

4-5. **Conference on Applied Mathematics (CAM)**, University of Central Oklahoma, Edmond, OK. (Dec. 1993, p. 1445)

6-10. **AMC 94: The Thirtieth Australian Applied Mathematics Conference**, Pokolbin, Hunter Valley, N.S.W. (Nov. 1993, p. 1253)

6-12. **C*-Algebren**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

7-11. **Differential Geometry, Hamiltonian Systems, and Operator Theory**, University of the West Indies, Mona, Jamaica. (Jul./Aug. 1993, p. 711)

10-11. **IMACS Workshop on Theoretical and Computational Aspects of Turbulence**, Rutgers University, New Brunswick, NJ. (Dec. 1993, p. 1445)

* 12-13. **Third Southern California Geometric Analysis Seminar**, University of California, Irvine, CA.

INVITED SPEAKERS: J.P. Bourguignon, Ecole Polytechnique; T. Lyons, Imperial College; W. Muller, Bonn; L. Simon, Stanford; R. Stern, UC Irvine; T. Wolff, UC Berkeley.

INFORMATION: P. Li, Dept. of Math., Univ. of California, Irvine, CA 92717; e-mail: pli@oac.uci.edu; tel.: 714-856-5510; fax: 714-856-7993.

13-19. **Funktionentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 285)

14-18. **Workshop on Galois Module Structure**, The Fields Institute, Waterloo, Ontario. (Nov. 1993, p. 1253)

14-March 4. **Winter College on Quantum Optics**, Trieste, Italy. (Dec. 1993, p. 1445)

18-23. **Section A (Mathematics) Sessions at the AAAS Annual Meeting**, San Francisco, CA. (Sep. 1993, p. 924)

20-26. **Harmonische Analyse und Darstellungstheorie Topologischer Gruppen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

27-March 5. **Mathematical Economics**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

28-March 4. **IMA Workshop on Stochastic Networks**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

28–March 4. **Workshop on Algebraic K-theory and Arithmetic**, The Fields Institute, Waterloo, Ontario. (Nov. 1993, p. 1253)

March 1994

4–5. **First Permian Basin Conference in Algebra and Number Theory**, The University of Texas of the Permian Basin, Odessa, TX. (Dec. 1993, p. 1445)

* 5–6. **A Celebration of Women in Mathematics**, MIT, Cambridge, MA.

PROGRAM: This conference is intended to illustrate the impressive contributions that women have made in mathematics. Colloquium-style lectures will be given by distinguished women mathematicians on a wide range of topics which will include analysis, differential geometry, dynamical systems, knot theory, minimal surfaces, mathematical physics, symplectic geometry, applied mathematics, and computing. This workshop is funded by the NSF Visiting Professorship for Women Program and supported by Brown Univ. and MIT. All mathematicians are cordially invited to attend.

LECTURERS: J. Birman, Columbia; D. McDuff, SUNY, Stony Brook; J. Mesirov, Thinking Machines; C. Morawetz, Courant; J. Pipher, Brown; J. Taylor, Rutgers; C. Lian Teng, Northeastern; K. Uhlenbeck, U. of Texas; L. Sang Young, U. of Arizona.

INFORMATION: Susan Friedlander, e-mail: susan@math.nwu.edu.

6–12. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

7–11. **Twenty-fifth Southeastern International Conference on Combinatorics, Graph Theory, and Computing**, Florida Atlantic University, Boca Raton, FL. (Sep. 1993, p. 924)

7–25. **Workshop on Fluid Mechanics**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 711)

13–17. **The UAB-Georgia Tech International Conference on Differential Equations and Mathematical Physics**, Birmingham, AL. (Oct. 1993, p. 1085)

13–19. **Elementare und Analytische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

16–19. **Prospects in Topology: A Conference on the Occasion of William Browder's 60th Birthday**, Princeton University, Princeton, NJ. (Dec. 1993, p. 1445)

17–19. **Seminar on Stochastic Processes 1994**, Texas A&M University, College Station, TX. (Sep. 1993, p. 925)

17–20. **Joint Workshop on Computational Aspects of Geometric Group Theory II**, DIMACS, Rutgers University, New Brunswick,

NJ. (Dec. 1993, p. 1445)

18–19. **Southeastern Section**, University of Kentucky, Lexington, Kentucky.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

20–26. **Regelungstheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

21–24. **IMA Period of Concentration: Stochastic Problems for Nonlinear Partial Differential Equations**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Dec. 1993, p. 1446)

21–25. **Symplectic Geometry of Moduli Spaces**, CIRM, Marseille/Luminy. (Sep. 1993, p. 925)

21–25. **L-functions Conference**, Fields Institute, Waterloo, Ontario. (Nov. 1993, p. 1254)

21–25. **International Conference on Computational Methods and Function Theory '94**, Penang, Malaysia. (Dec. 1993, p. 1446)

* 21–25. **Fourth Workshop and Miniconference on Operator Theory and Evolution Equations**, Louisiana State University, Baton Rouge, LA.

INVITED SPEAKERS: W. Arendt, Ph. Clement, I. Cioranescu, R. deLaubenfels, M. Demuth, K.H. Forster, M. Hieber, V. Keyantuo, C. Lizama, G. Lumer, M. Neumann, M. Pang, D. Pascali, V.Q. Phong, A. Venni, P. Vieten, V. Wrobel.

INFORMATION: G.R. Goldstein, F. Neubrander, Dept. of Math., LSU, Baton Rouge, LA 70803; gisele@marais.math.lsu.edu or neubrand@marais.math.lsu.edu; and L. Weis, Math. Inst., Univ. Kiel, 24118 Kiel 1, Germany; e-mail: nms29@rz.uni-kiel.d400.de.

22–24. **The Rhine Workshop on Computer Algebra**, Karlsruhe, Germany. (Sep. 1993, p. 925)

24–26. **Fourth Eugene Lukacs Symposium**, Bowling Green State University, Bowling Green, OH. (Oct. 1993, p. 1085)

24–27. **Joint 1994 Annual Spring Topology Conference and Southeast Dynamical Systems Conference**, Auburn University, Auburn, AL. (Nov. 1993, p. 1254)

25–26. **Central Section**, Kansas State University, Manhattan, KS.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

25–26. **Southeastern-Atlantic Section of SIAM**, Wake Forest University, Winston-Salem, NC. (Dec. 1993, p. 1446)

25–27. **Third Annual Boise Extravaganza in Set Theory (BEST) Conference**, Boise State University, Boise, Idaho. (Dec. 1993, p. 1446)

27–April 2. **Algebraische Gruppen**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

27–April 2. **Endliche Modelltheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

28–30. **Moduli Spaces, Galois Representations, and L-functions**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Jul./Aug. 1993, p. 711)

28–30. **Conference on Semigroup Theory and Its Applications in Memory of Alfred H. Clifford**, Tulane University, New Orleans, LA. (Dec. 1993, p. 1446)

28–31. **Twenty-fifth Annual Iranian Mathematics Conference**, Sharif University of Technology, Tehran, Iran. (Jul./Aug. 1993, p. 711)

29–31. **Data Compression Conference (DCC '94)**, Snowbird, Utah. (Dec. 1993, p. 1446)

31–April 2. **Mathematical Approaches to the Study of Nonlinear Materials**, Fayetteville, Arkansas. (Sep. 1993, p. 925)

April 1994

3–9. **Arbeitsgemeinschaft Mit Aktuellem Thema (wird in den Mitteilungen der DMV Heft 1/1994 Bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

4–10. **Colorado Conference on Iterative Methods**, Breckenridge, CO. (Nov. 1993, p. 1254)

* 5–7. **First Annual Meeting of the Saudi Association for Mathematical Sciences**, King Saud University, Riyadh, Saudi Arabia.

CONFERENCE TOPICS: Pure and applied mathematics, mathematical physics, statistics & O.R., mathematical education.

INFORMATION: Annual Meeting Committee, Dept. of Math., College of Science, King Saud Univ., P.O. Box 2455, Riyadh 11451, Saudi Arabia.

5–9. **MEGA-94, The Third International Symposium on Effective Methods in Algebraic Geometry**, Santander, Spain. (Jul./Aug. 1993, p. 711)

5–11. **Effective Methods in Algebraic Geometry (MEGA '93)**, Santander, Spain. (Mar. 1993, p. 286)

5–15. **Instructional Conference on Harmonic Analysis and Partial Differential Equations**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 711)

7–9. **1994 John H. Barrett Memorial Lectures on Zero-Dimensional Commutative Rings**, University of Tennessee, Knoxville, TN. (Nov. 1993, p. 1254)

8–9. **Mathematical Breakthroughs in the Twentieth Century**, The State University of New York at Farmingdale, NY. (Jul./Aug. 1993, p. 712)

8–9. **Illinois Number Theory Conference**,

University of Illinois, Urbana, IL. (Dec. 1993, p. 1447)

8–10. **Eastern Section**, Polytechnic University, Brooklyn, NY.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

*9–10. **Ninth Union College Conference on Category Theory, Algebraic Topology, and Set-theoretic Topology**, Union College, Schenectady, NY.

PROGRAM: Hour-long invited talks in category theory, algebraic topology, and set-theoretic topology, along with parallel sessions of contributed talks.

CALL FOR PAPERS: Abstract deadline: March 1, 1994.

INFORMATION: S. Niefield, niefields@gar.union.edu; B. Johnson, johnsonb@gar.union.edu; T. LaBerge, laberget@gar.union.edu.

10–16. **Numerical Linear Algebra with Applications**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

11–15. **Simulation for Emergency Management**, La Jolla, CA. (Dec. 1993, p. 1447)

*11–15. **Workshop on L-functions and Automorphic Forms**, The Fields Institute, Waterloo, Ontario, Canada.

ORGANIZER: K. Murty (U. of Toronto).

INVITED SPEAKERS: (*tentative) J. Arthur (U. of Toronto), D. Bump (Stanford U.), J. Cogdell (Oklahoma State U.), H. Darmon (Princeton U.), C. Deninger (U. of Munster), W. Duke (Rutgers U.)*, E. Fouvry (U. of Orsay)*, J. Friedlander (U. of Toronto), R. Gupta (U. of British Columbia)*, M. Harris (U. of Brandeis)*, H. Iwaniec (Rutgers U.), H. Jacquet (Columbia U.), S. Kudla (U. of Maryland), R. Murty (McGill U.), S. Rallis (Ohio State U.)*, D. Rohrlich (U. of Maryland)*, P. Sarnak (Princeton U.), R. Schulze-Pillot (U. of Cologne), F. Shahidi (Purdue U.), C. Stewart (U. of Waterloo), B. Sury (Tata Institute and U. of Toronto).

INFORMATION: For registration information contact J. Motts, The Fields Institute, 185 Columbia Street West, Waterloo, Ontario, Canada N2L 5Z5; automorp@fields.uwaterloo.ca, fax: 519-725-0704, phone: 519-725-0096.

*11–22. **Spring School and Workshop on String Theory, Gauge Theory, and Quantum Gravity**, Trieste, Italy.

CHAIRMAN: R. Dijkgraaf, R. Iengo, I. Klebanov, K.S. Narain, S. Randjbar-Daemi.

INFORMATION: International Centre for Theoretical Physics, P.O. Box 586, I-34100 Trieste.

*15–16. **Stochastic Systems and Their Appli-**

cations: A Conference in Honor of Harold J. Kushner, Newport, RI.

ORGANIZERS: P. Dupuis, A. Schwartz, G. Yin.

INVITED SPEAKERS: I. Karatzas, R.Z. Khasminskii, P.R. Kumar, T.G. Kurtz, L. Ljung, D. Mitra, M.I. Reiman, A.D. Wentzell, M. Zakai.

INFORMATION: J. D'Amico, The Lefschetz Center for Dynamical Systems, Brown University, Providence, RI 02912; 401-863-2358; e-mail: jmd@brownvm.brown.edu.

17–22. **International Conference on New Trends in Computer Science I (NETCOMS I)**, University of Ibadan, Nigeria. (Please note date change from Nov. 1992, p. 1121)

17–23. **Designs and Codes**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

18–20. **Conference on Emerging Issues in Mathematics and Computation from the Materials Sciences**, Pittsburgh, PA. (Sep. 1993, p. 925)

22–24. **North East Dynamics Meeting**, State University of New York, Stony Brook, NY. (Dec. 1993, p. 1447)

*24–27. **The Second Annual Object-Oriented Numerics Conference, OON-SKI '94**, Sunriver, Oregon.

PROGRAM: OON-SKI provides a forum where computer scientists and scientific programmers can discuss how to use object-oriented programming techniques to more effectively write complex scientific codes. There will be four separate areas of focus: object-oriented environments: design, development, and debugging tools; object-oriented analysis and design methodologies; object-oriented software components and class libraries; applications.

INFORMATION: M. Chapman, Program Coordinator, Rogue Wave Software, P.O. Box 2328, Corvallis, OR 97339; e-mail: amc@roguewave.com; tel: 503-754-3010; fax: 503-757-6650.

24–28. **First World Congress on Computational Medicine and Public Health**, University of Texas Center for High Performance Computing, Austin, TX. (Nov. 1993, p. 1255)

24–30. **Geschichte der Mathematik**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

25–29. **Third International Conference on p-adic Functional Analysis**, Clermont-Ferrand, France. (Sep. 1993, p. 925)

26. **Second Annual Workshop on I/O Parallel Computer Systems (to be held in conjunction with the International Parallel Processing Symposium-IPPS '94)**, Cancun, Mexico. (Dec. 1993, p. 1447)

*26–30. **International Conference on Logic**

and Algebra Dedicated to Roberto Magari on his 60th Birthday, Pontignano (Siena), Italy.

PROGRAM: The program will consist of long talks by invited speakers and short talks. The main topics will be logic, universal algebra, and algebraic proof theory.

SCIENTIFIC COMMITTEE: E. Fried, G. Gratzel, D. Mundici, F. Montagna, D. Pigozzi.

INVITED SPEAKERS: *Tentative* S. Artemov, E. De Giorgi, D. De Jong, E. Kiss, R. McKenzie, A. Pixley, G. Zappa.

FEE AND SUPPORT: The conference fee is expected to range between \$130–\$180 depending on outside support. A limited amount of support is available. Priority will be given to the participants coming from the former Eastern Block countries and, among them, to those contributing with a paper.

INFORMATION: MAGCONF, Dipartimento di Matematica, Via del Capitano, 53100 Siena, Italy; fax: (577)-270581; e-mail: magconf@sivax.cineca.it.

*29–May 1. **Fourth Midwest Geometry Conference**, University of Iowa, Iowa City, IA.

PLENARY SPEAKERS: M.T. Anderson, M. Gursky, A. Uribe, Z. Zhou.

INFORMATION: T. Branson, Dept. of Math., U. of Iowa, Iowa City, IA 52242; 319-335-0744; fax: 319-335-0627; branson@math.uiowa.edu.

May 1994

1–7. **Gruppentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

1–7. **Linear Operators and Application**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 712)

2–4. **Hard Problems in Mathematical Physics: A Meeting to Celebrate the Sixtieth Birthday of Paul Federbush**, Ann Arbor, MI. (Dec. 1993, p. 1447)

2–6. **IMA Workshop on Image Models (and Their Speech Model Cousins)**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

2–6. **International Conference on Topological Vector Spaces, Algebras, and Related Areas**, McMaster University, Hamilton, Ontario, Canada. (Mar. 1993, p. 286)

2–6. **Wavelet Analysis as a Tool for Geometric Synthesis and Analysis**, University of Minnesota, Minneapolis, MN. (Nov. 1993, p. 1255)

*2–6. **Conference on Massively Parallel Computing Systems (MPCS): the Challenges of General-Purpose and Special-Purpose Computing**, Ischia, Italy.

PROGRAM: This conference has been conceived to gather experts from research, academia, and industry who are interested in all problems related to the definition and implementation of massively parallel computing systems. A major goal of the conference is to foster communication and cooperation between communities studying general- and special-purpose massively parallel systems. The conference is organized in different sessions: 1) Keynote sessions by outstanding experts; 2) Regular and special sessions; and 3) Short-note and late paper sessions.

CONFERENCE TOPICS: Architecture of MPCs: processors and communication networks; design methods for MPCs, with particular reference to prototyping, validation, diagnosis, and quality assurance; general-purpose vs. special-purpose MPCs; interactions among programming languages, programming environments, and parallel architectures; impact of MPCs on effectiveness and efficiency of applications; programming environments for MPCs with reference to program transformation, load balancing high-level scheduling, and message routing; implementation of massively parallel I/O subsystems; tools for performance prediction and evaluation; abstract machines for MPCs; and fine-grain parallelism and parallel computer arithmetics.

SPECIAL SESSIONS: Communicating in MPCP systems; architecture of massively parallel computers for comp. vision/image processing; application specific massively parallel architecture implementation; and MPCs prototypes in European universities.

INFORMATION: G.R. Sechi, Program Chair, via Bassini, 15, 20133 Milano, Italy; tel: +39 2 2363747; fax: +39 2 2362946; e-mail: monica@ifctr.mi.cnr.it; or E. Attanasio or D. Nardo, via P. Castelino, 111, Napoli, Italy; tel: +39 81 5452419; fax: +39 81 5454330; erminia@inareavm.bitnet.

3-10. Spring College on Quantum Phases, Trieste, Italy.

CHAIRMAN: Solid State Advisory Committee.

INFORMATION: International Centre for Theoretical Physics, P.O. Box 586, I-34100 Trieste.

3-14. The Fourth International School on Differential Equations: Bifurcations and Chaos, Katsiveli, Crimea, Ukraine. (Sep. 1993, p. 926)

8-14. **Variationsrechnung**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

9-13. Algorithmes et Programmation, Marseille, France.

CHAIRMEN: D. Monasse, Paris; R. Roland, Aix-Marseille.

INFORMATION: CIRM, Luminy Case 916, F-13288 Marseille Cedex 9.

14-18. International Congress Henri Poincaré, Archives-Centre d'Etudes et de Recherche Henri-Poincaré, Nancy, France. (Jul./Aug. 1993, p. 712)

15-21. **Critical Phenomena in Spatial Stochastic Models**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 286)

16-20. **IMA Workshop on Stochastic Models in Geosystems**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

16-20. **Géométrie Algébrique**, CIRM, Marseille, France. (Jan. 1993, p. 64)

16-27. **Workshop on Commutative Algebra and its Relation to Combinatorics and Computer Algebra**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 712)

20-22. **Wavelets and Fractals**, University of Pittsburgh, Pittsburgh, PA. (Dec. 1993, p. 1448)

22-24. **Conference in Honor of E. Dynkin**, MSI, Ithaca, NY. (Jul./Aug. 1993, p. 712)

22-27. **Nonlinear Analysis, Function Spaces, and Applications, V**, Prague, Czech Republic. (Sep. 1993, p. 926)

22-28. **Diskrete Geometrie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

23-25. **Twenty-sixth Symposium on Theory of Computing (STOC)**, Montreal, Canada. (September 1993, p. 926)

23-25. **The 1994 Scalable High Performance Computing Conference, SHPCC94**, Knoxville, TN. (Nov. 1993, p. 1255)

23-27. **Elliptic and Parabolic Methods in Geometry**, University of Minnesota, Minneapolis, MN. (Nov. 1993, p. 1255)

* 23-27. Geometrie Algébrique, Marseille, France.

CHAIRMEN: L. Szpiro; R. Elkik, Paris; A.N. Pershin, Moscow.

INFORMATION: CIRM, Luminy Case 916, F-13288 Marseille Cedex 9.

24-27. **Conference on Hermann G. Graßmann (1809-1877)**, Isle of Rügen, Germany. (September 1992, p. 775)

* 24-28. International Workshop on Mathematical Methods and Tools in Computer Simulation, St. Petersburg State University, St. Petersburg, Russia. (Please note corrected information to Sep. 1993, p. 926)

INFORMATION: The correct e-mail address is statmod@hq.math.lgu.spb.su.

24-28. **First International Conference on Difference Equations and Applications**, Trinity University, San Antonio, TX. (Dec. 1993, p. 1448)

25-28. **Second Conference on Function Spaces**, Southern Illinois University at Edwardsville, Illinois. (Sep. 1993, p. 926)

* 26-27. Sixteenth Symposium on Mathematical Programming with Data Perturbations, George Washington University, Washington, DC.

PROGRAM: This symposium is designed to bring together practitioners who use mathematical programming optimization models and deal with questions of sensitivity analysis with researchers who are developing techniques applicable to these problems.

CONFERENCE TOPICS: Contributed papers in mathematical programming are solicited in the following areas: Sensitivity and stability analysis results and their applications; solution methods for problems involving implicitly defined problem functions; solution methods for problems involving deterministic or stochastic parameter changes; solution approximation techniques and error analysis. Clinical presentations that describe problems in sensitivity or stability analysis encountered in applications are also invited.

CALL FOR PAPERS: Abstracts of papers intended for presentation at the symposium should be sent in triplicate to the address below by March 15, 1994. Abstracts should provide a good technical summary of key results, avoid the use of mathematical symbols and references, not exceed 500 words, and include a title and the name and full mailing address of each author. Approximately 30 minutes will be allocated for each paper.

INFORMATION: A.V. Fiacco, Organizer, School of Engineering and Applied Science, The George Washington University, Washington, DC 20052; 202-994-7511.

26-28. **Spatial Stochastic Models in Biology**, The University of Colorado at Colorado Springs. (Nov. 1993, p. 1256)

26-29. **ICANN '94-International Conference on Artificial Neural Networks**, Sorrento Congress Center, near Naples, Italy. (Jul./Aug. 1993, p. 712)

29-June 3. **International Conference on Real and Complex Algebraic Geometry**, Soesterberg, The Netherlands. (Jul./Aug. 1993, p. 712)

29-June 4. **Singulare Störungsrechnung**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

29-June 4. **Spring School on Potential Theory and Analysis**, Paseky, Czech Republic. (Dec. 1993, p. 1448)

30-June 3. **On the Interaction between Functional Analysis, Harmonic Analysis, and Probability**, University of Missouri-Columbia, Columbia, MO. (Jul./Aug. 1993, p. 713)

* 30-June 3. **International Congress on Women Mathematicians**, Moscow, Russia.

PROGRAM: The work of the congress will be divided into four sections: 1. differential equations; 2. topology, algebra; 3. mathematical simulation; and 4. mathematical education.

CALL FOR PAPERS: The titles of the reports and abstracts are to be received before March 1, 1994.

INFORMATION: I. Yaroshevskaya, Center of Visiting Programs, Arch. Vlasova st., 51 Moscow, 117393, Russia; tel./fax: (095) 120-11-20; yarosh@orgmath.msk.su.

* 30-June 4. **Problemes en Homotopie Rationnelle**, Marseille, France.

CHAIRMAN: Y. Felix, Louvain; S. Halperin, Toronto; J.-C. Thomas, Lille.

INFORMATION: CIRM, Luminy Case 916, F-13288 Marseille Cedex 9.

30-June 9. **Workshop on Group Representation Theory**, Technion, Israel Institute of Technology, Haifa, Israel. (Dec. 1992, p. 1284)

31-June 3. **IMA Minisymposium on Phase Transitions in Catalytic Surface Reaction Models**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Jan. 1993, p. 64)

* 31-June 3. **Surfaces, Soap Bubbles, and General Relativity**, Frostburg State University, Frostburg, MD.

PURPOSE: To give college teachers a working knowledge of surfaces in space, curvature, soap bubbles, and general relativity.

LECTURER: F. Morgan, Frostburg State U. INFORMATION: B.A. Fusaro, Dept. of Math. & C.S., Salisbury State University, Salisbury, MD 21801; 410-543-6470.

June 1994

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)

2-19. **Constructivist Methods in Undergraduate Math Teaching: Calculus**, Purdue University, West Lafayette, IN. (Dec. 1993, p. 1448)

* 3-4. **Praha-Chemnitz-Torun Algebra Symposium**, Charles University, Faculty of Mathematics and Physics, Prague, Czech Republic.

ORGANIZING COMMITTEE: V. Dlab, D. Hapfel, T. Kepka, J. Trlifaj.

INVITED SPEAKERS: I. Agoston, Budapest; T. Kepka, Charles; H. Lenzing, Paderborn; M.-P. Malliavin, Paris; H. Meltzer, Chem-

nitz; D. Simson, Torun; A. Skowronski, Torun; J. Trlifaj, Charles; L. Unger, Paderborn.

INFORMATION: E. Novakova, katedra Algebry MFF UK, Sokolovska 83, 18600 Praha 8-Karlin, Czech Republic; e-mail: novakova@cspguk11.bitnet.

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. (Please note date change from Jul./Aug. 1993, p. 713)

6-10. **Applied and Industrial Mathematics**, University of Linköping, Linköping, Sweden. (Nov. 1993, p. 1256)

* 6-10. **Formes Quadratiques et Groupes Algébriques Lineaires**, Marseille, France.

CHAIRMAN: E. Bayer, Besancon; J.-L. Colliot-Thelene, Orsay; B. Kanhn, Paris; J.-P. Pignol, Louvain-La-Neuve.

INFORMATION: CIRM, Luminy Case 916, F-13288 Marseille Cedex 9.

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.

* 9-11. **Sixth Lehigh University Geometry/Topology Conference**, Bethlehem, PA

PROGRAM: Hour addresses by six invited speakers, plus parallel sessions of contributed 40-minute talks in differential geometry and algebraic or geometric topology.

INVITED SPEAKERS: J. Birman, Columbia; S. Cappell, NYU; D. DeTurck, Penn.; F. Morgan, Williams; M. Stern, Duke; C. Wilkerson, Purdue.

INFORMATION: D. Davis, e-mail: dmd1@lehigh.edu, 610-758-3756; or D. Johnson, dlj0@lehigh.edu, 610-758-3759; Dept. of Math., 14E. Packer Ave., Lehigh U., Bethlehem, PA 18015.

9-19. **Constructivist Methods in Undergraduate Math Teaching: Abstract Algebra**, Purdue University, West Lafayette, IN. (Dec. 1993, p. 1449)

11-July 6. **Joint Summer Research Conferences in the Mathematical Sciences**, Mount Holyoke College, South Hadley, Mas-

sachusetts. (Dec. 1993, p. 1449)

12-18. **Nichtlinearitäten vom Hysterestyp**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

* 13-14. **The 1994 IEEE Workshop on Fault-Tolerant Parallel and Distributed Systems**, College Station, TX.

PROGRAM: The goal of this workshop is to provide a forum for researchers to present and exchange research results and advances in the field of fault-tolerant parallel and distributed systems. Both hardware and system issues are of interest.

CONFERENCE TOPICS: Fault-tolerant multiprocessor systems; novel hardware architectures; high speed microprocessor issues; formal methods for specification, design, and verification of parallel and distributed systems; reliable design and synthesis tools; fault model issues; fault-tolerant networks; experimental systems; recovery techniques; software fault tolerance; real-time systems; empirical studies and system validation.

CALL FOR PAPERS: Send five copies of a full manuscript not exceeding 5000 words to the address below by February 18, 1994. All submissions must be original and never published.

INFORMATION: D.K. Pradhan, Dept. of Comp. Sci., Texas A&M Univ., College Station, TX 77843; tel: 409-862-2438; fax: 409-862-2758; pradhan@cs.tamu.edu.

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. (Please note additional information to Sep. 1993, p. 927)

PLENARY SPEAKERS AND TOPICS: J. Demmel, U. of California, Berkeley, Eigenvalue computation; P. Diaconis, Harvard U., Geometry and eigenvalues; I. Gohberg, Tel Aviv U., Matrix theory; A. Greenbaum, Courant Inst., NYU, Iterative methods for large sparse systems; C.R. Johnson, College of William and Mary, Nonnegative

matrices: Can the next century Top This One?; R.S. Schreiber, RIACS-NASA Ames Res. Ctr., Parallel matrix computations; L.E. Trotter, Cornell U., Linear algebraic duality for discrete optimization.

INVITED MINISYMPOSIA: A. Bunse-Gerstner, U. of Bremen, Numerical methods for structured matrices; T.F. Coleman, Cornell U., Linear algebra in optimization; I. Duff, Rutherford Appleton Labs. and CERFACS, Direct methods for large sparse systems; R. Freund, AT&T Bell Labs., Iterative methods for large sparse systems; P. Lancaster, U. of Calgary, The algebraic Riccati equation and applications; A. Pothén, U. of Waterloo, Graph theory and linear algebra; G. Strang, MIT, Teaching of linear algebra.

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.

* 18–19. **IMS Workshop on Directions in Sequential Analysis**, Chapel Hill, NC.

PROGRAM: The workshop precedes the joint meetings of the Inst. of Math. Stats. and the Bernoulli Society. The purpose is to provide an international forum for sharing and promoting research in theoretical and applied aspects of sequential methodology in statistics and probability. Formal presentations will be made by forty invited speakers.

ORGANIZING COMMITTEE: M. Woodroffe, G. Simons, A.N. Shiryayev, P.K. Sen, T.L. Lai, and B.K. Ghosh.

INFORMATION: B.K. Ghosh, Dept. of Math., Lehigh U., Bethlehem, PA 18015; e-mail: bkg0@lehigh.edu; tel: 215-758-3722; fax: 215-758-3079.

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. **Probabilités Quantiques**, Marseille, France.

CHAIRMAN: J.-L. Sauvageot, Paris.

INFORMATION: CIRM, Luminy Case 916, F-13288 Marseille Cedex 9.

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–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.

CHAIRMEN: H. Cerdeira, B. Kramer, G. Schön.

INFORMATION: International Centre for Theoretical Physics, P.O. Box 586, I-34100 Trieste.

* 21–24. **NASECODE X: The Tenth International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits**, Dublin, Ireland.

CONFERENCE TOPICS: Analysis, code validation against real devices and processes, computational techniques, device modeling, electrothermal effects, energy transport models, manufacturing equipment modeling, mathematical analysis, Monte Carlo simulations, physical aspects, process models, process simulation, quantum dot, quantum well and quantum effects, quantum tunneling, simulation of integrated circuits and VLSI interconnections, TCAD frameworks, TCAD industrial applications, transciuit and interconnection analysis and simulation.

CALL FOR PAPERS: Potential authors should submit three copies of a camera ready abstract (two pages, 297 × 210mm, 1000 words maximum) by March 31, 1994. Authors must clearly state the purpose of the work, the specific original results obtained, and their significance.

INFORMATION: NASECODE X Conference, 26 Temple Lane, Dublin 2, Ireland; telefax: (+353-1) 679 2469; tel: (+353-1) 679 7655.

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–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.

INFORMATION: E. Goodman, John Wiley and Sons Publishers, 605 Third Avenue, New York, NY 10158; 212-850-6711.

25–July 2. **Symposium on Diophantine Problems in Honor of Wolfgang Schmidt's 60th Birthday**, Boulder, Colorado. (May/Jun. 1993, p. 514)

26–July 2. **Graphentheorie**, Oberwolfach, Federal Republic of Germany. (Mar. 1993, p. 287)

26–July 2. **Inverse Problems**, Lake St. Wolfgang, Austria. (May/Jun. 1993, p. 514)

27–July 2. **Convex and Discrete Geometry**, Bydgoszcz, Poland. (Dec. 1993, p. 1450)

28–July 1. **Structure in Complexity Theory, Ninth Annual IEEE Conference**, Amsterdam, The Netherlands. (Nov. 1993, p. 1256)

July 1994

2–8. **Fourth Conference of the Canadian Number Theory Association**, Dalhousie University, Halifax, Nova Scotia, Canada. (Sep. 1993, p. 927)

3–9. **Analysis und Geometrie Singulärer Räume**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

4–7. **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. **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)

* 4–29. **Miniworkshop on Quantum Phase Transitions**, Trieste, Italy.

CHAIRMEN: E. Tosatti, Y. Lu.

INFORMATION: International Centre for Theoretical Physics, P.O. Box 586, I-34100 Trieste.

5–9. **Twenty-fourth National Conference on Geometry and Topology (CNGT 24)**, University of Timișoara, Romania. (Jul./Aug. 1993, p. 713)

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)

10–16. **Freie Randwertprobleme**, Oberwol-

Meetings and Conferences

fach, Federal Republic of Germany. (Apr. 1993, p. 415)

*** 10-16. Euroconference: Combinatorial Geometry**, Anogeia, Crete, Greece.

ORGANIZERS: P. Mani, Bern; J. Wills, Siegen; G. Ziegler, Berlin.

SUPPORT: Full financial support for travel and expenses for a number of young researchers from E.C. countries (possibly also from some Central and East European countries).

INFORMATION: S. Papadopoulou, Dept. of Math., University of Crete, P.O. Box 1470, Iraklion, Crete, Greece; e-mail: suzana@talos.cc.uch.gr; fax: 81-234516.

*** 10-30. The Park City/Institute for Advanced Study Mathematics Institute**, Park City, Utah.

PROGRAM: High school teachers, in partnership with university mathematicians and students, will explore the evolution of classical geometry to modern geometry on curved spaces, and will discuss issues of geometry education and reform. Undergraduates and graduate students will be offered an intense, yet accessible, introduction to areas of research and application by nationally respected leaders in mathematics. The Research and Graduate Summer School topic for the 1994 summer session is "Gauge Theory and the Topology of Four-Manifolds". Active researchers will have a stimulating but informal working environment. A range of computer activities and problems in geometry can be explored by participants in a fully networked computer lab.

APPLICATION DEADLINE: March 1, 1994.

INFORMATION: PC/IAS Mathematics Institute, 18C DeTrobriand St., Salt Lake City, UT 84113; tel.: 801-585-3488; fax: 801-585-5793; e-mail: pcmi@math.utah.edu.

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)

11-22. 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.

CHAIRMAN: J.A. Krumhans.

INFORMATION: International Centre for Theoretical Physics, P.O. Box 586, I-34100 Trieste.

14-18. LFCS'94: Logic at St. Petersburg, a Symposium on Logical Foundations of Computer Science, St. Petersburg, Russia.

(Jul./Aug. 1993, p. 714)

17-23. Conférence Internationale de Topologie, CIRM, Marseille, France. (Jan. 1993, p. 64)

17-23. Algebraische Zahlentheorie, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

17-23. Workshop on Harmonic Analysis and Elliptic Partial Differential Equations, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Jul./Aug. 1993, p. 714)

*** 17-23. Euroconference: Actions of Lie Groups and Discrete Subgroups on Manifolds**, Anogeia, Crete, Greece.

ORGANIZERS: G. Margoulis, Yale; R. Zimmer, Chicago.

SUPPORT: Full financial support for travel and expenses for a number of young researchers from E.C. countries (possibly also from some Central and East European countries).

INFORMATION: S. Papadopoulou, Dept. of Math., University of Crete, P.O. Box 1470, Iraklion, Crete, Greece; e-mail: suzana@talos.cc.uch.gr; fax: 81-234516.

18-22. Sixth International Conference on Fibonacci Numbers and Their Applications, Washington State University, Pullman, WA. (Jul./Aug. 1993, p. 714)

*** 18-22. Conférence Internationale de Topologie**, Marseille, France.

CHAIRMEN: Y. Mathieu, Marseille.

INFORMATION: CIRM, Luminy Case 916, F-13288 Marseille Cedex 9.

18-29. Fifth Workshop of Stochastic Analysis of Oslo-Silivri, Silivri, Istanbul, Turkey. (Oct. 1993, p. 1087)

*** 20-22. International Symposium on Symbolic and Algebraic Computation, ISSAC '94**, St. Catherine's College, Oxford, UK.

CONFERENCE TOPICS: Algorithms for problems in algebra, number theory, group theory, algebraic geometry, differential algebra and differential equations; combined symbolic/numeric methods; languages and systems for symbolic computation; parallel symbolic computation; automatic theorem proving and programming; applications of symbolic computation to mathematics, science, engineering, and education.

CALL FOR TOPICS: Papers may be submitted either electronically in \LaTeX form using a standard article style or (preferred) as Postscript files, or in hard copy form. The preferred format is 12pt., with a maximum of 10 pages. Papers must be received by January 15, 1994.

INFORMATION: M. MacCallum, School of Math. Sci., Queen Mary and Westfield College, Mile End Road, London E1 4NS, UK; mm@maths.qmw.ac.uk; or J. von

zur Gathen, Dept. of Comp. Sci., Univ. of Toronto, Toronto, Ontario M5S 1A4, Canada; issac@cs.toronto.edu; or S. Hague, NAG Ltd., Wilkinson House, Jordan Hill Rd., Oxford OX2 8DR, UK steve@nag.co.uk.

20-30. Third Souslin Conference, Saratov, Russia. (Jul./Aug. 1993, p. 714)

24-30. Complex Geometry: Moduli Problems, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 415)

25-29. Représentation des Groupes Reductifs p -adiques, CIRM, Marseille, France. (Nov. 1992, p. 1122)

25-29. 1994 SIAM Annual Meeting, San Diego, CA. (Sep. 1993, p. 927)

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.

SCIENTIFIC COMMITTEE: Saunders Mac Lane, Chicago; J. Adamek, Prague; J. Bénabou, Paris; F. Borceux, Louvain; A. Carboni, Milano; P. Dampousse, Tours; Y. Diers, Valenciennes; R. Guitart, Paris; J. Gray, Urbana; H. Herrlich, Bremen; P. Johnstone, Cambridge; M. Kelly, Sidney; I. Moerdijk, Utrecht; G. Reyes, Montreal.

PREREGISTRATION: Send a one-line e-mail to ecct-request@univ-tours.fr with the one line subscribe.

CALL FOR PAPERS: Deadline for submitting papers is April 1, 1994.

INFORMATION: Contact via e-mail: dampous@univ-tours.fr or guitart@univ-tours.fr or write to ECCT, c/o P. Dampousse, Dept. de Math., Faculté des Sciences, Parc de Grandmont, Tours 37200, France.

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.

ORGANIZERS: M. Karoubi, B. Kahn, R. Thomason.

INVITED SPEAKERS: G. Carlsson, H. Gillet, U. Janssen, K. Kato, M. Levine, I. Panin, J. Rognes, M. Rost, C. Soule, A. Suslin.

REGISTRATION: Deadline for registration is April 5, 1994.

INFORMATION: E-mail to kthconf@frmap711.mathp7.jussieu.fr or fax: (33-1)-44276366 or write to Algebraic K-theory Conference, L. Barenghi, UFR de Math., Univ. de Paris VII, Case 7012, 75251 Paris Cedex 05, France.

27-August 1. International Conference on Commutative Algebra (A Satellite Confer-

ence 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 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. 1451)

3–11. **The International Congress of Mathematicians 1994**, Zürich, Switzerland. (Jul./Aug. 1993, p. 714)

7–13. **Effiziente Algorithmen**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

12–20. **1994 Summer Workshop-Conference on Classical and Quantum Geometry of Homogeneous Spaces**, International Sophus Lie Centre, Moscow. (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)

14–20. **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"**, Bosphorus 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)**, Eras-

mus University, Rotterdam, The Netherlands. (Dec. 1993, p. 1452)

* 15–19. **1994 International Conference on Parallel Processing**, The Pennsylvania State University, University Park, PA.

INFORMATION: T. Feng, The Pennsylvania State University, 220 Pond Lab., University Park, PA 16802-6106.

15–26. **Advanced Workshop on Algebraic Geometry**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 714)

16–20. **ICMI-China Regional Conference on Mathematics Education**, Shanghai, China. (Jul./Aug. 1993, p. 714)

18–23. **Fifth Colloquium on Differential Equations**, Plovdiv, Bulgaria. (Apr. 1993, p. 416)

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)

21–27. **Mathematical Models in Phase Transitions**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

22–26. **Sixth Conference on Numerical Methods in Hungary**, Miskolc University, Miskolc, Hungary. (Sep. 1993, p. 928)

27–28. **Conference on the History of Mathematics in Honor of Boris Rosenfeld**, Pennsylvania State University, University Park, PA. (Dec. 1993, p. 1452)

28–September 3. **Komplexe Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

September 1994

September 1994. **Suslin Jubilee International Conferences**, Suslin Foundation, Russia. (Oct. 1993, p. 1088)

* Fall 1994. **Workshop on Exterior Differential Systems and Applications**, Centre de Recherches Mathématiques, Université de Montréal.

PROGRAM: There will be a program of visitors, both short- and long-term, with more informal activities organized in consequence. Special emphasis will be placed on the integration of graduate students into the year's activities. In particular, each workshop will be preceded by a minicourse of one or two weeks to prepare students for the workshop. There will also be a full program of term-length graduate courses given both by local faculty and by visitors on topics covered by the program.

SCIENTIFIC COMMITTEE: L. Vinet, director of CRM; S. Boyer, UQAM; R. Bryant, Duke; A. Casson, Berkeley; Y. Eliashberg,

Stanford; M. Gromov, IHES; I. Hambleton, McMaster; N.J. Hitchin, Warwick; J. Hurtubise, McGill; N. Kamran, McGill; F. Lalonde, UQAM; M. Min-oo, McMaster; D. Rolfsen, UBC; M. Troyanov, UQAM.

WORKSHOP TOPICS: Exterior differential systems; Cartan's equivalence problem; applications to the calculus of variations, to Riemannian geometry, and to the study of pdes.

INFORMATION: M. Louise Pelletier, CRM, Université de Montréal, C.P. 6128, Succursale A, Montréal, Québec H3C 3J7, Canada; pellet1@ere.umontreal.ca.

* Fall 1994. **Workshop on Geometry of Non-compact Manifolds**, Centre de Recherches Mathématiques, Université de Montréal.

PROGRAM: See the preceding listing for the program and a list of the scientific committee.

WORKSHOP TOPICS: Asymptotic invariants, harmonic functions, spectra of Laplacians, invariants of quasi-isometry.

INFORMATION: M. Louise Pelletier, CRM, Université de Montréal, C.P. 6128, Succursale A, Montréal, Québec H3C 3J7, Canada; pellet1@ere.umontreal.ca.

4–10. **Topologie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

5–8. **ECCOMAS-Second European Computational Fluid Dynamics Conference**, Stuttgart, Germany. (Dec. 1993, p. 1452)

* 5–9. **IX Brazilian Meeting of Topology**, Universidade Federal Fluminense, Instituto de Matematica, Niteroi, Rio de Janeiro, Brazil.

PURPOSE: To promote interchange among the Brazilian topologists throughout the country and abroad.

CONFERENCE TOPICS: Foliations, locally free actions of groups, bounded cohomology, characteristic classes, K-theory, bordism, and others.

INVITED SPEAKERS: *Partial list*: E. Ghys, ENS Lyon; U. Koschorke, U. Gesamthochschule; W. Mio, U. Florida; J. Palis, IMPA; P. Schweitzer, PUC/RJ; T. Tsuboi, U. Tokyo; B. Williams, U. of Notre Dame.

INFORMATION: S. Firmo, IX Encontro Brasileiro de Topologia, Rua Sao Paulo s/n - Valonguinho, 24020-005, Niteroi-RJ-Brazil; fax: 55 21 717 4553; e-mail: ebtuff@brlncc.bitnet.

6–8. **International Conference on Parallel Processing: CONPAR 94-VAPP VI**, Linz, Austria. (Oct. 1993, p. 1088)

* 7–9. **IEEE European Workshop on Computer-Intensive Methods in Control and Signal Processing: Can We Beat the Curse of Dimensionality?**, Prague, Czech Republic.

PROGRAM: The aim of this workshop is to bring together researchers and practitioners

working in academia, government, and industry. Particular emphasis will be placed on "The curse of dimensionality", i.e., the extreme dimensionality of computations connected with the implementation of theoretically optimal mathematical procedures of inference and decision making.

CONFERENCE TOPICS: Parallel algorithms and architectures; neural nets; model reduction; finite-dimensional estimation, filtering, and control; complexity; multivariate integration and optimization; nontraditional approaches.

INFORMATION: M. Karny, IEEE Workshop "CMP", Institute of Information Theory and Automation, P.O. Box 18, 182 08 Prague, Czech Republic; tel: +(42)(2)6641 3421; fax: +(42)(2)6641 4903; e-mail: kulhava@utia.cas.cz (Internet).

11-17. **Homotopietheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

15-19. **Fifteenth International Symposium on Mathematical Programming**, University of Michigan, Ann Arbor, MI. (Apr. 1993, p. 416)

18-20. **Teaching of Mathematics for Industry**, Prague. (Jul./Aug. 1993, p. 715)

18-24. **Risk Theory**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

18-24. **DMV-Jahrestagung 1994 (Annual Meeting of the German Mathematical Society)**, Duisberg, Federal Republic of Germany. (Nov. 1993, p. 1258)

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)

25-October 1. **Mathematical Methods in Tomography**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

26-October 1. **First International Workshop on Functional Analysis**, Trier University, near Luxembourg, Germany. (Oct. 1993, p. 1088)

* 26-30. **Journées de Probabilités**, Marseille, France.

CHAIRMEN: J. Azéma, M. Yor, Paris.

INFORMATION: CIRM, Luminy Case 916, F-13288 Marseille Cedex 9.

* 28-30. **Third International Conference on Parallel and Distributed Information Systems**, Austin, Texas.

CONFERENCE TOPICS: While the scope of this conference includes all aspects of parallelism and distribution in database systems, submissions presenting results and experience in these and other emerging areas

of database research are especially invited. Submissions are solicited in all aspects of information systems that deal with parallelism and/or distribution.

CALL FOR PAPERS: Original papers on the above topics are invited. These should be no longer than twenty-five double-spaced pages with no smaller than 11 point type. Please submit six copies to a program chair at one of the addresses below to arrive no later than March 28, 1994.

INFORMATION: H. Korth, MITL, Panasonic Technologies, Inc., 2 Research Way, Princeton, NJ 08540-6628; e-mail: hfk@mitl.research.panasonic.com; or A. Sheth, Bellcore, RRC-1J210, 444 Hoes Lane, Piscataway, NJ 08854; amit@ctt.bellcore.com.

October 1994

2-8. **Randelementmethoden: Anwendungen und Fehleranalysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

9-15. **Arbeitsgemeinschaft mit Aktuellem Thema (Wird in den Mitteilungen der DMV Heft 3/1994 Bekanntgegeben)**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

10-28. **School/Workshop on Variational and Local Methods in the Study of Hamiltonian Systems**, International Centre for Theoretical Physics, Trieste, Italy. (Jul./Aug. 1993, p. 715)

12-18. **CARI '94: Second African Conference on Research in Computer Science**, Ouagadougou (Burkina-Faso). (Nov. 1993, p. 1259)

16-22. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

23-29. **Wahrscheinlichkeitsmaße auf Gruppen und Verwandten Strukturen**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

* 24-November 11. **Fourth Autumn Course on Mathematical Ecology**, Trieste, Italy.

CHAIRMEN: L. Gross, T. Hallam, S. Levin.

INFORMATION: International Centre for Theoretical Physics, P.O. Box 586, I-34100 Trieste.

28-29. **Central Section**, Oklahoma State University, Stillwater, Oklahoma.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

30-November 5. **Finite Volume Methods**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 416)

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)

November 1994

11-13. **Southeastern Section**, University of Richmond, Richmond, VA.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

13-17. **1994 International Symposium on Logic Programming**, MSI, Ithaca, NY. (Jul./Aug. 1993 p. 715)

13-19. **Komplexitätstheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

20-26. **Mathematical Aspects of Computational Fluid Dynamics**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

27-December 3. **Mathematical Models for Infectious Diseases**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

December 1994

4-10. **Applied Probability**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1993, p. 715)

12-14. **SIAM Conference on Inverse Problems**, Fish Camp, CA. (Dec. 1993, p. 1453)

18-23. **Asymptotik Hochdimensionaler Statistischer Modelle**, Oberwolfach, Federal Republic of Germany. (Apr. 1993, p. 417)

Second International Conference on Numerical Methods for Volterra and Delay Equations (A conference to celebrate the 100th anniversary of Volterra's birth.), Italy. (Mar. 1992, p. 251)

January 1995

4-7. **Joint Mathematics Meetings**, San Francisco, CA (including the annual meetings of the AMS, AWM, MAA, and NAM).

INFORMATION: H. Daly, AMS, P.O. Box 6887, Providence, RI 02940.

* 16-19. **First Asian Computational Fluid Dynamics Conference**, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong.

CONFERENCE TOPICS: Newly developed schemes and algorithms; incompressible flows; compressible flows, hypersonic flows, and rarefied gas flows; turbulent flow computation; transition and modelling; reacting flows; multiphase flows; meteorology and oceanography; applications to aeronautics and astronautics; applications to structural, civil, and environmental engineering; finite element methods; unstructured grid scheme; parallel computation in computational fluid dynamics.

Meetings and Conferences

INFORMATION: Conference Secretary, Dept. of Math., Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong; fax: 852-358-1643; e-mail: asiacfd@usthk.bitnet.

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.

March 1995

4-5. Eastern Section, Hartford, Connecticut.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

17-18. Southeastern Section, Orlando, Florida.

INFORMATION: W.S. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

24-25. Central Section, DePaul University, Chicago, IL.

INFORMATION: W. Drady, AMS, P.O. Box 6887, Providence, RI 02940.

April 1995

* Spring 1995. Workshop on Groups and Three-Manifolds, Centre de Recherches Mathématiques, Université de Montréal.

PROGRAM: There will be a program of visitors, both short- and long-term, with more informal activities organized in consequence. Special emphasis will be placed on the integration of graduate students into the year's activities. In particular, each workshop will be preceded by a minicourse of one or two weeks to prepare students for the workshop. There will also be a full program of term-length graduate courses given both by local faculty and by visitors on topics covered by the program.

SCIENTIFIC COMMITTEE: L. Vinet, director of CRM; S. Boyer, UQAM; R. Bryant, Duke; A. Casson, Berkeley; Y. Eliashberg, Stanford; M. Gromov, IHES; I. Hambleton, McMaster; N.J. Hitchin, Warwick; J. Hurtubise, McGill; N. Kamran, McGill; F. Lalonde, UQAM; M. Min-oo, McMaster; D. Rolfsen, UBC; M. Troyanov, UQAM.

WORKSHOP TOPICS: Progress on Thurston's Geometrization conjectures, group actions on trees, properties of three-manifold groups. INFORMATION: M. Louis Pelletier, CRM, Université de Montréal, C.P. 6128, Succursale A, Montréal, Québec H3C 3J7, Canada; pellet1@ere.umontreal.ca.

* Spring-Summer 1995. Workshop on Gauge

Theory and Applications to Low-dimensional Topology, Centre de Recherches Mathématiques, Université de Montréal.

PROGRAM: See the preceding listing for the program and the scientific committee.

WORKSHOP TOPICS: Yang-Mills moduli and applications to four-dimensional topology; applications of ideas from theoretical physics to geometry and topology.

INFORMATION: M. Louis Pelletier, CRM, Université de Montréal, C.P. 6128, Succursale A, Montréal, Québec H3C 3J7, Canada; pellet1@ere.umontreal.ca.

* Spring-Summer 1995. Workshop on Symplectic Geometry and Topology, Centre de Recherches Mathématiques, Université de Montréal.

PROGRAM: See the preceding listing for the program and a list of the scientific committee.

WORKSHOP TOPICS: Geometry of symplectic manifolds and of Lagrangian manifolds, elliptic techniques, and variational techniques.

INFORMATION: M. Louis Pelletier, CRM, Université de Montréal, C.P. 6128, Succursale A, Montréal, Québec H3C 3J7, Canada; pellet1@ere.umontreal.ca.

23-26. KdV '95, Amsterdam, The Netherlands. (Dec. 1993, p. 1453)

July 1995

* 3-7. The Third International Congress on Industrial and Applied Mathematics, CCH Congress Centrum, Hamburg, Germany.

PROGRAM: The program will focus worldwide attention on the importance of mathematical and computational methods in the solution of real world problems. The program consists of invited and contributed lectures, minisymposia, poster presentations, and an exhibition.

CONFERENCE TOPICS: Presentations are solicited in all areas of applied mathematics, computer science, applied probability and statistics, scientific computing, and applications in science, medicine, engineering, economics, and other related fields.

CALL FOR PAPERS: Participants are invited to submit a paper, which may be presented in lecture or poster format. Authors will have approximately 15 minutes for the lecture, with an additional five minutes for discussion. Alternatively, poster presentations will allow interactive discussions with individuals interested in their work. Deadline for papers is August 31, 1994.

INFORMATION: GAMM-Office, Univ. Regensburg, NWF I-Mathematik, D-93053 Regensburg, Germany; tel: +49-941-943-4918; fax: +49-941-943-4005; iciam95@

vax1.rz.uni-regensburg.d400.de.

* 10-12. Conference on Linear Algebra and its Applications, University of Manchester, England.

ORGANIZING COMMITTEE: N.J. Higham, chair, U. of Manchester; I.S. Duff, Rutherford Appleton Labs.; R. Fletcher, U. of Dundee; T.L. Freeman, U. of Manchester; S.J. Hammarling, NAG Ltd.; N.K. Nichols, U. of Reading.

INFORMATION: P. Irving, The Conference Officer, The Institute of Mathematics and its Applications, 16 Nelson St., Southend-on-Sea, Essex, SS1 1EF, UK; tel: 0702 354020; fax: 0702 354111.

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.

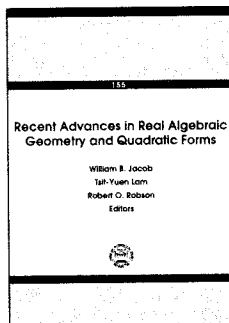
January 1997

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.

New Publications Offered by the AMS

CONTEMPORARY MATHEMATICS



Recent Advances in Real Algebraic Geometry and Quadratic Forms

William B. Jacob,
Tsit-Yuen Lam, and
Robert O. Robson, Editors
Volume 155

The papers in this volume grew out of a year-long program in "Real Algebraic Geometry and Quadratic Forms", held at the University of California at Berkeley during the 1990–1991 academic year. This valuable collection of research articles by top workers serves as a record of current developments in these areas and as a tribute to the fruitful interaction between them. Students and researchers alike will find this book a useful reference, with articles ranging from the technical to the expository. Also included are summaries of the current developments in several subdisciplines and indications of new research directions.

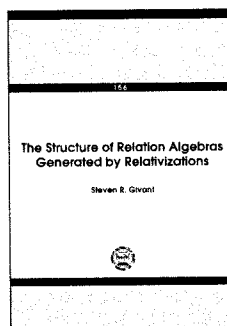
Contents

T. Recio and C. Andradas, *D. W. Dubois and the pioneer days of real algebraic geometry*; **Papers on real algebraic geometry**: **S. Akbulut**, *On algebraic structures of manifolds*; **C. Andradas and J. M. Ruiz**, *On local uniformization of orderings*; **R. Berr**, *Real algebraic geometry over p -real closed fields*; **L. Bröcker**, *On the reduction of semialgebraic sets by real valuations*; **T. C. Craven**, *Orderings for noncommutative rings*; **C. N. Delzell**, *Nonexistence of analytically varying solutions to Hilbert's 17th problem*; **M. A. Dickmann**, *A combinatorial geometric structure on the space of orders of a field II*; **M. J. González-López and T. Recio**, *Formal determination of polynomial consequences of real orthogonal matrices*; **R. Huber and M. Knebusch**, *On valuation spectra*; **M. Marshall**, *Minimal generation of basic sets in the real spectrum of a commutative ring*; **A. Pfister**, *A new proof of the homogeneous nullstellensatz for p -fields, and applications to topology*; **M. J. de la Puente**, *The compatible valuation rings of the coordinate ring of the real plane*; **G. Stengle**, *Estimates for parametric nonuniformity in representations of a definite polynomial as a sum of fourth powers*; **Papers on quadratic forms**: **J. Kr. Arason, R. Elman, and B. Jacob**, *On generators for the Witt ring*; **E. Becker and T. Wörmann**, *On the trace formula for quadratic forms*; **W. Bichsel and M.-A. Knus**, *Quadratic forms with values in line bundles*; **M. Krüskemper**, *On annihilators in graded Witt rings and in Milnor's K -theory*; **K. H. Leung**, *An application of the theory of order completions*; **D. B. Leep and A. S. Merkurjev**, *Growth of the u -invariant under algebraic extensions*; **J. Mináč**, *Remarks on Merkurjev's investigations of the u -invariant*; **R. Parimala and W. Scharlau**, *On the canonical class of a curve and the extension property for quadratic forms*;

R. Parimala and R. Sridharan, *Reduced norms and pfaffians via Brauer-Severi schemes*; **R. Perlis, K. Szymiczek, P. E. Conner, and R. Litherland**, *Matching Witts with global fields*; **J. Shick**, *On Witt-kernels of function fields of curves*; **V. Suresh**, *On the canonical class of hyperelliptic curves*.

1991 *Mathematics Subject Classification*: 00B25, 11Exx, 14Pxx
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The Structure of Relation Algebras Generated by Relativizations

Steven R. Givant
Volume 156

The foundation for an algebraic theory of binary relations was laid by De Morgan, Peirce, and Schröder during the second half of the nineteenth century. Modern development of the subject as a theory of abstract algebras, called "relation algebras",

was undertaken by Tarski and his students. This book aims to analyze the structure of relation algebras that are generated by relativized subalgebras. As examples of their potential for applications, the main results are used to establish representation theorems for classes of relation algebras and to prove existence and uniqueness theorems for simple closures (i.e., for minimal simple algebras containing a given family of relation algebras as relativized subalgebras). This book is well-written and accessible to those who are not specialists in this area. In particular, it contains two introductory chapters on the arithmetic and the algebraic theory of relation algebras. This book is suitable for use in graduate courses on algebras of binary relations or algebraic logic.

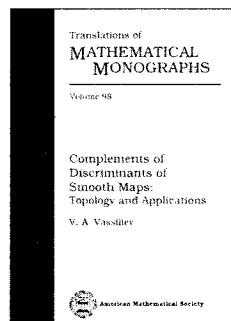
Contents

Basic definitions and laws; Algebraic notions; The characteristic of an equivalence element; The arithmetic of rectangles; Structure theorems; Existence, uniqueness, and representation theorems; Relation algebras generated by equivalence elements; Bibliography; Index of symbols; Index of names and subjects.

1991 *Mathematics Subject Classification*: 03G15; 08A05, 08A30
ISBN 0-8218-5177-2, LC 93-36607, ISSN 0271-4132
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TRANSLATIONS OF MATHEMATICAL
MONOGRAPHS**Complements of
Discriminants of Smooth
Maps: Topology and
Applications, Revised
Edition**

V. A. Vassiliev

Volume 98

This book studies a large class of topological spaces, many of which play an important role in differential and homotopy topology, algebraic geometry, and catastrophe theory. These include spaces of Morse and generalized Morse functions, iterated loop spaces of spheres, spaces of braid groups, and spaces of knots and links. Vassiliev develops a general method for the topological investigation of such spaces. One of the central results here is a system of knot invariants more powerful than all known polynomial knot invariants. In addition, a deep relation between topology and complexity theory is used to obtain the best known estimate for the numbers of branchings of algorithms for solving polynomial equations. In this revision, Vassiliev has added a section on the basics of the theory and classification of ornaments, information on applications of the topology of configuration spaces to interpolation theory, and a summary of recent results about finite-order knot invariants. Specialists in differential and homotopy topology and in complexity theory, as well as physicists who work with string theory and Feynman diagrams, will find this book an up-to-date reference on this exciting area of mathematics.

Contents

Introduction; Cohomology of braid groups and configuration spaces; Applications: Complexity of algorithms, superpositions of algebraic functions and interpolation theory; Topology of spaces of real functions without complicated singularities; Stable cohomology of complements of discriminants and caustics of isolated singularities of holomorphic functions; Cohomology of the space of knots; Invariants of ornaments; Appendix 1. Classifying spaces and universal bundles. Join; Appendix 2. Hopf algebras and H-spaces; Appendix 3. Loop spaces; Appendix 4. Germs, jets, and transversality theorems; Appendix 5. Homology of local systems; Bibliography.

1991 *Mathematics Subject Classification*: 55P35, 57M25, 57R45

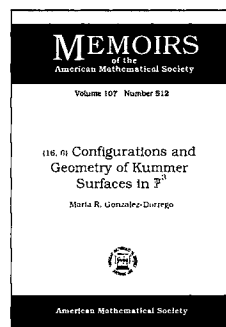
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MEMOIRS OF THE AMS

**(16, 6) Configurations and
Geometry of Kummer
Surfaces in \mathbb{P}^3**

Maria R. Gonzalez-Dorrego

Volume 107, Number 512

This monograph studies the geometry of a Kummer surface in \mathbb{P}^3_k and of its minimal desingularization, which is a K3 surface (here k is an algebraically closed field of characteristic different from 2).

This Kummer surface is a quartic surface with sixteen nodes as its only singularities. These nodes give rise to a configuration of sixteen points and sixteen planes in \mathbb{P}^3 such that each plane contains exactly six points and each point belongs to exactly six planes (this is called a “(16,6) configuration”). A Kummer surface is uniquely determined by its set of nodes. Gonzalez-Dorrego classifies (16,6) configurations and studies their manifold symmetries and the underlying questions about finite subgroups of $PGL_4(k)$. She uses this information to give a complete classification of Kummer surfaces with explicit equations and explicit descriptions of their singularities. In addition, the beautiful connections to the theory of K3 surfaces and abelian varieties are studied.

Contents

Introduction; The classification of (16,6) configurations; The classification of Kummer surfaces in \mathbb{P}^3 ; Divisors on a Kummer surface and its minimal desingularization; Geometry of a Kummer surface in \mathbb{P}^3 and the associated abelian variety; References.

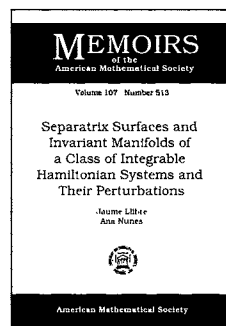
1991 *Mathematics Subject Classification*: 51A35, 51N35, 14J28

ISBN 0-8218-2574-7, LC 93-39029, ISSN 0065-9266

101 pages (softcover), January 1994

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**Separatrix Surfaces
and Invariant Manifolds
of a Class of Integrable
Hamiltonian Systems
and Their Perturbations**Jaume Llibre and
Ana Nunes

Volume 107, Number 513

This work presents a study of the foliations of the energy levels of a class of integrable Hamiltonian systems by the sets of constant energy and angular momentum. This includes a classification of the topological bifurcations and a dynamical characterization of the critical leaves (separatrix surfaces) of the foliation. Llibre and Nunes then consider Hamiltonian perturbations of this class of integrable Hamiltonians and give conditions for the persistence of the separatrix structure of the foliations and for the existence of transversal ejection-collision orbits of the perturbed system. Finally, they consider a class of non-Hamiltonian perturbations of a family of integrable systems of the type studied earlier and prove the persistence of “almost all” the tori and cylinders that

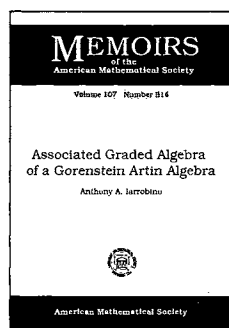
foliate the energy levels of the unperturbed system as a consequence of KAM theory.

Contents

Introduction and statement of the results; Bifurcations; Separatrix surfaces and foliations of the energy levels; The perturbed Hamiltonian; References.

1991 *Mathematics Subject Classification*: 70H05
ISBN 0-8218-2581-X, LC 93-39026, ISSN 0065-9266
191 pages (softcover), January 1994

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Associated Graded Algebra of a Gorenstein Artin Algebra

Anthony A. Iarrobino
Volume 107, Number 514

In 1904, Macaulay described the Hilbert function of the intersection of two plane curve branches: It is the sum of a sequence of functions of simple form. This monograph describes the structure of the tangent cone of the intersection

underlying this symmetry. Iarrobino generalizes Macaulay's result beyond complete intersections in two variables to Gorenstein Artin algebras in an arbitrary number of variables. He shows that the tangent cone of a Gorenstein singularity contains a sequence of ideals whose successive quotients are reflexive modules. Applications are given to determining the multiplicity and orders of generators of Gorenstein ideals and to problems of deforming singular mapping germs. Also included are a survey of results concerning the Hilbert function of Gorenstein Artin algebras and an extensive bibliography.

Contents

Gorenstein Artin algebras and duality; The intersection of two plane curves; Extremal decompositions; Components of the Hilbert scheme strata; What decompositions D and subquotients $Q(a)$ can occur?; Relatively compressed Artin algebras; Bibliography; List of theorems, definitions, and examples; Index.

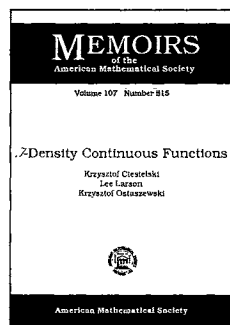
1991 *Mathematics Subject Classification*: 13H10; 13A30, 13D10, 13D40, 13E10, 14B05, 58C27

ISBN 0-8218-2576-3, LC 93-39027, ISSN 0065-9266

115 pages (softcover), January 1994

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I-Density Continuous Functions

Krzysztof Ciesielski,
Lee Larson, and
Krzysztof Ostaszewski
Volume 107, Number 515

The classical approach to showing the parallel between theorems concerning Lebesgue measure and theorems concerning Baire category on the real line is restricted to sets of measure zero and sets of first

category. This is because classical Baire category theory does not have an analogue for the Lebesgue density theorem. By using I -density, this deficiency is removed, and much of the structure of measurable sets and functions can be shown to exist in the sense of category as well. This monograph explores category analogues to such things as the density topology, approximate continuity, and density continuity. In addition,

some questions about topological semigroups of real functions are answered.

Contents

The ordinary density topology; Category analogues of the density topology; I -density continuous functions; Semigroups; Appendix A. Notation; References; Index.

1991 *Mathematics Subject Classification*: 26A21; 28A05

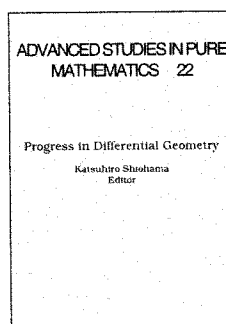
ISBN 0-8218-2579-1, LC 93-39028, ISSN 0065-9266

133 pages (softcover), January 1994

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ADVANCED STUDIES IN PURE MATHEMATICS



Progress in Differential Geometry

Katsuhiko Shiohama, Editor
Volume 22

This volume brings together twenty-five research papers and two survey articles on differential geometry and global analysis, areas in which Japanese differential geometers have recently made great progress. Urakawa's paper is a deep and comprehensive survey on recent results and

open problems in differential geometry, including Green functions and Liouville type theorems. Yamaguchi's survey deals with the Lie algebra of all infinitesimal automorphisms of a differential system on a manifold and presents basic material on the geometry of differential systems and simple graded Lie algebras over the real or complex numbers. The research articles cover such topics as minimal surfaces, submanifold theory, analysis on manifolds, L^2 -cohomology theory, and Riemannian geometry. This book will appeal to mathematicians interested in modern differential geometry, as well as to graduate students who are looking for a good overview of some of the main trends in this field.

Advanced Studies in Pure Mathematics is published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and is distributed worldwide, except in Japan, by the American Mathematical Society.

Contents

K. Enomoto, Compactification of submanifolds in Euclidean space by the inversion; **H. Fujimoto**, Gauss maps of complete minimal surfaces; **N. Innami**, Applications of Jacobi and Riccati equations along flows to Riemannian geometry; **G. Ishikawa**, Maslov class of an isotropic map-germ arising from one-dimensional symplectic reduction; **T. Iwai and Y. Uwano**, On symmetry groups of the MIC-Kepler problem and their unitary irreducible representations; **S. Izumiya**, Geometric singularities for Hamilton-Jacobi equation; **T. Kakehi and C. Tsukamoto**, Characterization of images of Radon transforms; **M. Koiso**, A uniqueness result for minimal surfaces in S^3 ; **T. Koda and K. Sekigawa**, Self-dual Einstein Hermitian surfaces; **H. Omori, Y. Maeda and A. Yoshioka**, Non-commutative complex projective space; **Y. Matsushita**, Some remarks on fields of 2-planes on compact smooth 4-manifolds; **R. Miyaoka**, A note on Lie contact manifolds; **K. Nagatomo**, Rational solutions of the Ernst equation; **H. Naitoh**, Submanifolds of symmetric spaces and Gauss maps; **Y. Nakamura**, Lax equations associated with a least squares problem and compact Lie algebras; **M. Okada**, Green function on self-similar trees; **K. Ono**, On a theorem of Edmonds; **T. Ohsawa**, On the L^2 cohomology groups of isolated singularities; **Y. Se-ashi**, A geometric construction of Laguerre-Forsyth's canonical forms of linear ordinary differential equations; **K. Shiohama and M. Tanaka**, The length

function of geodesic parallel circles; **T. Shioya**, Diameter and area estimates for S^2 and P^2 with nonnegatively curved metrics; **K. Sugahara**, On the poles of Riemannian manifolds of nonnegative curvature; **S. Takakuwa**, Bubbling of minimizing sequences for prescribed scalar curvature problem; **H. Urakawa**, Geometry of Laplace-Beltrami operator on a complete Riemannian manifold; **K. Yagi**, Super Lie groups; **K. Yamaguchi**, Differential systems associated with

simple graded Lie algebras; **T. Yamaguchi**, Tits metric and visibility axiom.

1991 Mathematics Subject Classification: 53

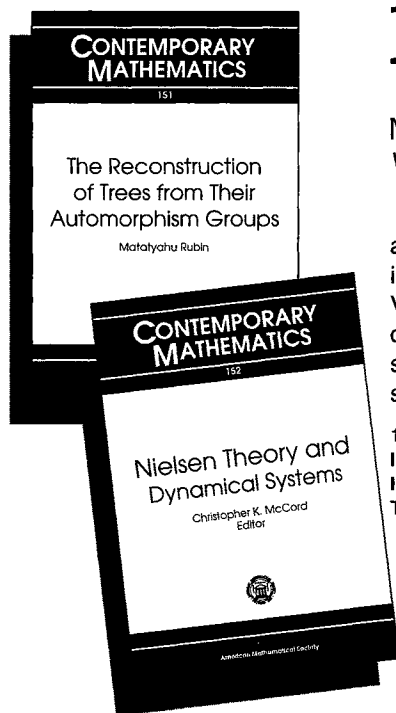
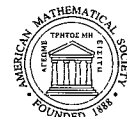
ISBN 4-314-10105-9

505 pages (hardcover), 1993

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CONTEMPORARY MATHEMATICS



The Reconstruction of Trees from Their Automorphism Groups

Matatyahu Rubin

Volume 151

This book focuses on automorphism groups of trees, providing a nearly complete analysis of when two trees have isomorphic automorphism groups. Special attention is paid to the class of \aleph_0 -categorical trees, and for this class the analysis is complete. Various open problems, mostly in permutation group theory and in model theory, are discussed, and a number of research directions are indicated. Aimed at graduate students and researchers in model theory and permutation group theory, this self-contained book will bring readers to the forefront of research on this topic.

1991 Mathematics Subject Classification: 03; 20, 06

ISBN 0-8218-5187-X, 274 pages (softcover), September 1993

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Nielsen Theory and Dynamical Systems

Christopher K. McCord, Editor

Volume 152

This volume contains the proceedings of the AMS-IMS-SIAM Joint Summer Research Conference on Nielsen Theory and Dynamical Systems, held in June 1992 at Mount Holyoke College. Focusing on the interface between Nielsen fixed point theory and dynamical systems, this book provides an almost complete survey of the state of the art of Nielsen theory. Most of the articles are expository and provide references to more technical works, making them accessible to both graduate students and researchers in algebraic topology, fixed point theory, and dynamical systems.

1991 Mathematics Subject Classification: 54, 55; 34, 58

ISBN 0-8218-5181-0, 350 pages (softcover), September 1993

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AMS Reports and Communications

Election Results of 1993

In the election of 1993, 4806 valid ballots were returned and counted.

Cathleen S. Morawetz was elected president-elect. She will serve one-year in this position after which she will serve for two years as president and one year as ex-president.

Jean E. Taylor was elected to a three-year term as vice-president.

There are five newly elected members-at-large of the Council: Robert K. Lazarsfeld, Frank Morgan, Norberto Salinas, Sylvia M. Wiegand, and Robert J. Zimmer. Each will serve a three-year term.

Donald J. Lewis was elected to a five-year term as a trustee.

Elected to three-year terms on the Council's Nominating Committee were Morris W. Hirsch, Hugh L. Montgomery, and Linda Preiss Rothschild.

Members elected to the Council's Editorial Boards Committee for three-year terms were Carolyn S. Gordon and Martin Golubitsky.

The proposed amendment to the By-laws passed.

All terms begin on 1 February 1994 except those for the Nominating Committee, which begin on 1 January 1994.

The report of the tellers may be obtained by contacting the secretary of the Society. The full list of members of the Council, the Board of Trustees, and the members of the Executive Committee will appear in a future issue of the *Notices*.

Robert M. Fossum
Secretary
Urbana, Illinois

The September Meeting in Syracuse

The 884th meeting of the Society was held in Syracuse, New York, on the campus of Syracuse University. There were

266 registrants, including 171 members of the Society.

Invited Addresses. By invitation of the Northeastern Section Program Committee, there were four invited speakers. The speakers, their affiliations, and their titles were as follows: TADEUSZ IWANIEC, Syracuse University, *Nonlinear PDEs and harmonic integrals in quasiconformal analysis*; CHARLES A. MCGIBBON, Wayne State University, *The rational homology of the p -adic completion of a sphere*; JAMES M. RENEGAR, Cornell University, *Complexity theory, round-off errors and linear programming*; and ALVANY ROCHA, Graduate School and University Center (CUNY), *Minimal series representations and conformal symmetry*.

Special Sessions. By invitation of the same committee, there were ten special sessions. The topics and names and affiliations of the organizers follow: *Geometric Topology*, DOUGLAS R. ANDERSON, Syracuse University.

Algebraic Topology, ROBERT BRUNER and CHARLES A. MCGIBBON, Wayne State University.

Commutative Algebra and Algebraic Geometry, STEVEN P. DIAZ, Syracuse University, and ANTHONY V. GERAMITA, Queen's University.

Harmonic Analysis, ALLAN GREENLEAF, University of Rochester, and ROBERT S. STRICHARTZ, Cornell University.

Differential Geometry and Global Analysis, WU-TEH HSIANG, Syracuse University.

Representations of Finite Dimensional Algebras, MARK KLEINER and DAN ZACHARIA, Syracuse University.

Nonlinear Potential Theory, JUAN J. MANFREDI, University of Pittsburgh.

Topics in Probability, TERRY R. MCCONNELL, Syracuse University.

Computational Problems Involving Polynomials, PAUL PEDERSEN and JAMES

M. RENEGAR, Cornell University.

Lie Theoretic Methods in Mathematical Physics, ALVANY ROCHA, Graduate School and University Center (CUNY).

Contributed Papers. There were four sessions of contributed papers.

Local Arrangements. These were most ably handled by Dan Waterman of Syracuse University, assisted by Patti Ford, both of whom did a superb job of coordinating all the details of such a large sectional meeting.

Lesley M. Sibner
Associate Secretary
Brooklyn, New York

The October Meeting in College Station

The 886th meeting of the Society was held on the campus of Texas A&M University, College Station, Texas, on Friday, October 22, and Saturday, October 23, 1993. There were 320 registrants, including 251 members of the Society. There were 36 student registrants.

Invited Addresses. By invitation of the Central Section Program Committee, there were four invited one-hour addresses. The speakers, their affiliations, and the titles of their talks were as follows: GILLES PISIER, University of Paris VI and Texas A&M University, *Hilbertian operator spaces*; STEVEN P. LALLY, Purdue University, *Symbolic dynamics, probability, and counting problems in geometry*; THEODORE A. SLAMAN, University of Chicago, *The structure of definability*; and STEPHEN A. STOLZ, University of Notre Dame, *Nonconnected moduli spaces of positive sectional curvature metrics*.

The speakers were introduced by David Larson, Carl Cowan, Neil Sloane, and Phillip Yasskin, respectively.

Special Sessions. By invitation of the same committee, there were thirteen special sessions of selected twenty-

minute papers. The topics of these sessions and the names and affiliations of the organizers were as follow:

Harmonic Analysis and its Applications, JOSEFINA ALVAREZ, New Mexico State University.

Several Complex Variables, HAROLD P. BOAS, AL BOGGESS, and EMIL J. STRAUBE, Texas A&M University, College Station.

Composition Operators on Spaces of Analytic Functions, RANDALL K. CAMPBELL-WRIGHT, University of Tampa; CARL C. COWEN, Purdue University; and BARBARA D. MACCLUER, University of Richmond.

Nonlinear Partial Differential Equations, ALFONSO CASTRO, JOSEPH A. IAJA, JOHN W. NEUBERGER, and HENRY A. WARCHALL, University of North Texas.

Control Systems Governed by Partial Differential Equations, GOONG CHEN and JIANXIN ZHOU, Texas A&M University, College Station.

Texas Geometry and Topology, TIM D. COCHRAN, Rice University; LORENZO A. SADUN, University of Texas at Austin; and PHILIP B. YASSKIN, Texas A&M University, College Station.

Reaction Diffusion Systems, WILLIAM E. FITZGIBBON, University of Houston, and J. J. MORGAN, Texas A&M University, College Station.

Nonselfadjoint Operator Algebras, DAVID R. LARSON, Texas A&M University, College Station.

Representation Theory and Geometry of Noncommutative Algebras, EDWARD S. LETZTER, Texas A&M University, College Station.

Identities and Varieties of Algebraic Structures, JOHN C. MEAKIN, University of Nebraska-Lincoln; AMITAI REGEV, Pennsylvania State University, University Park; MARK V. SAPIR, University of Nebraska-Lincoln; and SAMUEL M. VOVS, Trenton State College.

Noncommutative Differential Geometry, EFTON L. PARK, Texas Christian University.

The Geometry of Banach Spaces and Operator Spaces, GILLES PISIER and THOMAS SCHLUMPRECHT, Texas A&M University, College Station.

Algebraic Combinatorics, SUNG YELL SONG, Iowa State University, and PAUL M. TERWILLIGER, University of Wisconsin, Madison.

The sessions on Several complex variables, Control systems governed by partial differential equations, Texas geometry and topology, Reaction diffusion systems, Nonselfadjoint operator algebras, Representation theory and geometry of noncommutative algebras, and The geometry of Banach spaces and operator spaces were dedicated to the memory of Ilya Bakelman, professor of mathematics at Texas A&M University and formerly chair professor and head of the geometry section at Leningrad Pedagogical University, who died unexpectedly in 1992.

Contributed Papers. There was one session for contributed ten-minute papers chaired by Susan Geller of Texas A&M University.

Committee. Local arrangements were made by Ms. Karola Pletz, Editorial Assistant and Administrative Assistant (ret.) of the Department of Mathematics of Texas A&M University, with the assistance of her staff.

Andy R. Magid
Associate Secretary
Norman, Oklahoma

History of Mathematics

Lectures in the History of Mathematics

Henk J. M. Bos
Volume 7

This volume contains eleven lectures ranging over a variety of topics in the history of mathematics. The lectures, presented between 1970 and 1987, were delivered in a variety of venues and appeared only in less accessible publications. Those who teach mathematics, as well as mathematics historians, will appreciate this insightful, wide-ranging book.

1991 *Mathematics Subject Classification*: 00, 01

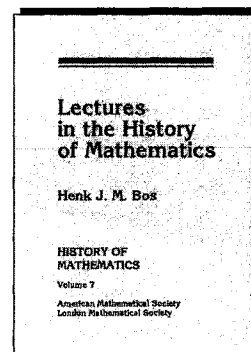
ISBN 0-8218-9001-8, 197 pages (hardcover), December 1993

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Miscellaneous

Personals

Kazimierz Goebel, of Marie-Curie Skłodowska University, was named rector of that university and was elected president of the Polish Mathematical Society.

Leon Henkin, professor emeritus of the University of California, Berkeley, has been named a Phi Beta Kappa Visiting Scholar for 1993–1994, during which he will visit nine institutions.

Gerald A. Heuer, of Concordia College, has been awarded an MAA Certificate of Meritorious Service for 1993 and will be a visiting professor at Graz University (Austria) from January–May 1994.

Charles W. Peck, of the California Institute of Technology, was named chair of the Division of Physics, Mathematics, and Astronomy at that institution.

Jon L. Sicks, of the University of

Massachusetts, Amherst, has been promoted to professor at that institution.

Andrew J. Woldar, of Villanova University, will be visiting the Institute for Advanced Study in Princeton, New Jersey, January–April 1994.

Deaths

Robert O. Abernathy, of Orangeburg, South Carolina, died on July 19, 1993. He was born on April 16, 1927, and was a member of the Society for 36 years.

Maurice J. Bresson, of Divonne-Les-Bains, France, died on March 6, 1993. He was born on May 13, 1921, and was a member of the Society for 27 years.

R. P. Dilworth, professor emeritus of the California Institute of Technology, died on October 29, 1993. He was born in December 1914, and was a member

of the Society for 56 years.

Eldon Dyer, professor emeritus of the Graduate School and University Center of the City University of New York, died on October 26, 1993. He was born on June 19, 1929, and was a member of the Society for 45 years.

Charles G. Lange, of the University of California, Los Angeles, died on June 25, 1993. He was born on March 30, 1942, and was a member of the Society for 25 years.

Henrik H. Martens, of the University of Trondheim, died on October 10, 1993. He was born on March 16, 1927, and was a member of the Society for 39 years.

Bertram Ross, retired professor of mathematics from the University of New Haven, died on October 27, 1993. He was born on October 17, 1918, and was a member of the Society for 29 years.

LECTURES ON MATHEMATICS IN THE LIFE SCIENCES

Lectures on Mathematics in the
LIFE SCIENCES
Predicting Spatial Effects
in Ecological Systems
1991 Symposium on
Some Mathematical Questions in Biology
August 4–6, 1991
San Antonio, Texas
Robert H. Gardner
Editor

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

Robert H. Gardner, Editor
Volume 23

The central themes of these papers are the characterization of effects, exploration of mechanisms, and understanding of consequences of spatial heterogeneity on ecological systems. The new mathematical approaches presented here will be especially useful for identifying the effect of landscape change on ecosystem productivity and sustainability. Mathematicians and ecologists interested in these issues will find this book useful, and individual chapters will be of interest to physicists, econometricians, landscape ecologists, and human ecologists.

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

ISBN 0-8218-1174-6, 168 pages (softcover), October 1993

Individual member \$20, List price \$33, Institutional member \$26

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POSITIONS AVAILABLE

ALABAMA

THE UNIVERSITY OF ALABAMA Department of Mathematics

The department hopes to have available, beginning August 16, 1994, a tenure-track position at the rank of assistant professor. Applicants whose research interests are in group theory, ring theory, or homological algebra are preferred. Applicants in other areas may be considered.

The successful candidate shall have completed the Ph.D. degree or equivalent by August 15, 1994. Excellence in research and a strong commitment to teaching are required.

Applicants should send curriculum vitae, reprints and/or preprints, and at least three letters of recommendation to: Search Committee, Department of Mathematics, The University of Alabama, Box 870350, Tuscaloosa, AL 35487-0350. Preliminary enquiries may be addressed to Martyn Dixon (205-348-5154; e-mail: mdixon@mathdept.as.ua.edu). UA is an affirmative action/equal opportunity employer. Women and minorities are particularly encouraged to apply.

considered but those in the following areas are particularly encouraged: functional analysis, numerical analysis, number theory, differential geometry, and partial differential equations.

We seek a candidate with a Ph.D. in mathematics who shows strong potential in teaching and research, who has the promise to strengthen our undergraduate and graduate programs, and who will appreciate the unique geography and climate of interior Alaska.

Please send a curriculum vitae, with a description of professional interests and aspirations, and arrange that three letters of recommendation be sent directly to:

The Search Committee
Department of Mathematical Sciences
University of Alaska Fairbanks
P.O. Box 756660
Fairbanks, AK 99775-6660

Application files will be reviewed starting February 24, 1994. We welcome applications from traditionally underrepresented groups. UAF is an AA/EO employer and educational institution.

ARIZONA

NORTHERN ARIZONA UNIVERSITY Department of Mathematics Position in Statistics

The Department of Mathematics of Northern Arizona University invites applications for a tenure-track position for an assistant professor in statistics. Preference will be given to those with a doctorate in statistics, strong theoretical background, interest in applied statistics and intramural consulting, and the ability to contribute

to the development of an interactive research group in statistics. In addition, qualifications include substantial evidence of high quality teaching and demonstrated potential for a productive, quality research program. At present, there are three statisticians and two probabilists in the Department. The starting date is August 22, 1994.

Northern Arizona University has an on-campus enrollment of 16,000. The Department of 28 tenure-track faculty offers Bachelor's and Master's degrees with emphases in mathematics, mathematics education, statistics, and actuarial science.

To apply, send letter of application with vita and direct three letters of reference to: Screening Committee, Department of Mathematics, P. O. Box 5717, Northern Arizona University, Flagstaff, Arizona 86011. The search will remain open until the position is filled. The Screening Committee will begin reviewing applications January 17, 1994. The University is an equal employment opportunity/affirmative action institution; women and underrepresented minorities are encouraged to apply.

CALIFORNIA

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

Subject to the availability of funding, one tenure track teaching position in mathematics at the assistant professor level, salary dependent upon qualifications. Doctorate in Mathematics or related field and expertise in ordinary, partial, and/or stochastic differential equations and their applications to modeling required. Evidence of potential for excellent teaching and scholarly research required. Closing date 3/30/94; position starting 9/94. Cal Poly Pomona is actively seeking to maintain its heritage and identity as a comprehensive center of education that serves a dynamic, multicultural region (with 58% ethnic minorities). For additional information or to apply, contact: Search Committee, Mathematics Dept., California State Polytechnic University, 3801 W. Temple Avenue, Pomona, CA 91758-4033. 909-869-3467. EOE/AA

CALIFORNIA STATE UNIVERSITY, HAYWARD Department of Mathematics and Computer Science

The department seeks applicants for a tenure-track appointment, effective Fall 1994, at the Assistant Professor rank. Applicants should hold a Ph.D. in mathematics. The successful candidate will be expected to teach a variety of mathematics courses ranging from service courses for the Business School to graduate courses in analysis and differential equations. The teaching load is 3 courses per quarter, with classes meeting both day and evening. Beyond a commitment to excellent teaching, candidates should exhibit the competence and potential to engage in significant professional activities, including research and publication.

ALASKA

UNIVERSITY OF ALASKA, FAIRBANKS

Applications are invited for an anticipated tenure track position at the assistant professor level. Applicants in all areas of mathematics will be

Send resume and names of 3 references to Mathematics Faculty Search Committee by January 15, 1994. CSUH (AA/EOE), with an ethnically diverse student body, encourages applications from women and men of all ethnic backgrounds and physical abilities. Position #94-95 MATH-TT.

**CALIFORNIA STATE UNIVERSITY,
NORTHIDGE
Faculty Positions
Department of Mathematics**

California State University, Northridge, seeks one tenure-track assistant professor and, depending on qualifications, one assistant or associate professor beginning Fall 1994. The availability of these positions is subject to final approval of funding. A Ph.D. in Mathematics or equivalent completed by August 1994 is required and excellent accomplishments or potential in one of the following areas: algebra, analysis, geometry, applied mathematics, or topology. In addition the successful applicant must have a strong commitment to teaching and a willingness to interact and collaborate with colleagues.

Responsibilities include teaching a maximum of 12 units per semester with possible reductions in the teaching load to carry out research or to make other professional contributions. Upper division and graduate classes are often held in the evening.

CSUN is located in the Los Angeles area and is in close proximity to Caltech, UCLA, and USC.

To apply submit a letter describing your specific qualifications, vita, and three letters of recommendation to Department of Mathematics, Hiring Committee, CSUN, 18111 Nordhoff St., Northridge, CA 91330-8313.

Application deadline: February 1, 1994.

California State University, Northridge, is an Equal Opportunity/Affirmative Action, Title IX, Section 504, Employer. Applications from women, minorities, and persons with disability are particularly encouraged.

**UNIVERSITY OF CALIFORNIA, IRVINE
Department of Mathematics
Irvine, CA 92715-3875**

Applications are invited for several one or two year Visiting Assistant Professor positions in the following areas of research: 1) applied and computational mathematics; 2) geometry and topology (includes geometric analysis); 3) analysis and PDE (includes mathematical physics); 4) algebra and number theory (includes algebraic and arithmetic geometry); 5) logic and set theory; 6) probability. Strong promise in research and teaching is required. Salary \$30,500-\$38,800. Teaching load: 5 to 6 quarter courses per year. Applicants should send a resume, preprints, reprints, dissertation abstract and ask three people to send letters of recommendation to: Recruitment Committee, at the above address. The deadline for application is January 31, 1994, or until the position is filled. The University of California is an Equal Oppor-

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**UNIVERSITY OF CALIFORNIA,
LOS ANGELES
Department of Mathematics
Regular Positions in Pure and
Applied Mathematics**

Subject to availability of resources and administrative approval, one regular position in pure and applied mathematics. The six specific search areas are as follows: 1) statistics; 2) applied and computational mathematics; 3) logic and mathematical computer science; 4) geometry and topology (including dynamical systems and geometric partial differential equations); 5) analysis and differential equations (including mathematical physics); 6) algebra, number theory, and combinatorics (including representations). Very strong promise in research and teaching required. Positions initially budgeted at the assistant professor level. Sufficiently outstanding candidates at higher levels will also be considered. Teaching load: averaging 1.5 courses per quarter, or 4.5 quarter courses per year. To apply, send electronic mail to search@math.ucla.edu OR write to Thomas M. Liggett, Chair, Department of Mathematics, University of California, Los Angeles, CA 90024-1555. Attn: Staff Search. UCLA is an equal opportunity/affirmative action employer.

**UNIVERSITY OF CALIFORNIA, RIVERSIDE
Department of Mathematics
Position in Topology**

Applications and nominations are invited for a tenured or tenure track position in Topology beginning July 1, 1994, or later. The position is at the Assistant or Associate Professor level. A Ph.D. in Mathematics or related specialization area is required. Demonstrated excellence in research and teaching is essential. Responsibilities include teaching undergraduate and graduate level courses and seminars, conducting scholarly research, and participating in service activities. Established criteria of the University of California determine salary and rank. To assure full consideration, applicants should send their curriculum vita, including a list of publications, and have at least three letters of recommendation sent to:

Professor David Rush
Topology Hiring Committee
Department of Mathematics
University of California
Riverside, CA 92521-0135

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**UNIVERSITY OF CALIFORNIA,
SANTA BARBARA
Department of Mathematics**

The University of California, Santa Barbara invites applications for the following positions in

the Department of Mathematics, beginning fall 1994.

(1) *Ky Fan Assistant Professorship*: Candidates will be considered in the following mathematical areas: linear and nonlinear functional analysis, harmonic analysis, and computational complexity. The Ky Fan assistant professorship is a special two-year nonrenewable position which carries a research stipend. Appointment is effective July 1, 1994, and candidates must possess a Ph.D. by September 1994. Selection will be based primarily on research achievement, but evidence of satisfactory teaching is necessary. Teaching load will consist of 4 one quarter courses per year.

(2) *Tenure track position*: Applications are invited for a tenure-track appointment at the assistant professor level, effective July 1, 1994, in the area of numerical analysis of nonlinear partial differential equations. Candidates should have a command of the field of the numerical analysis of nonlinear partial differential equations, demonstrated excellence in research in associated numerical applied mathematics, and have a command of and interest in the development of associated rigorous mathematical theories. A demonstrated excellence in the design, analysis, and implementation of algorithms for the computation of solutions of nonlinear partial differential equations is highly desirable as is the ability and desire to interact with scientists in applied areas such as engineering and physics. The appointee will also have the potential to provide leadership in the acquisition of new computational facilities, demonstrated the potential to become an effective teacher, and completed the Ph.D. degree by September 1994.

(3) *Special visiting positions*: Subject to availability of funds, one or more special one-year visiting assistant professorships in the research areas mentioned under (1) and (2) above, with possibility of a second year, carrying a teaching load of approximately 5 one quarter courses per year. Applicants for the Ky Fan and the tenure track positions will automatically be considered for the visiting positions. Excellence in research, potential for interaction with other 94/96 faculty and evidence of good teaching required. Candidates must possess a Ph.D. by September 1994.

Applicants should send a vita, a publication list, a one-page statement of research interests, and arrange to have three letters of recommendation sent to: the Ky Fan Committee for the Ky Fan position, to the Numerical Analysis Committee for the tenure track position, and to the Visiting Appointment Committee for the special visiting positions (but only if not otherwise applying) at the address: Department of Mathematics, University of California, Santa Barbara, CA 93106. Include an e-mail address if available. Applications which are complete by January 15, 1994, will be given full consideration.

UCSB is an affirmative action/equal opportunity employer.

UNIVERSITY OF SOUTHERN CALIFORNIA Los Angeles, California

The Department of Mathematics anticipates several tenure-track or possible tenured positions at the Assistant and/or Associate Professor level. Applicants must show strong research promise and possess excellent communications skills for teaching undergraduate mathematics courses. Visiting positions (at all levels) and postdoctoral appointments will also be available.

To apply, please submit the following materials in a single package: letter of application (including your e-mail address and fax number), and a curriculum vitae. Candidates for junior positions should also provide at least three letters of recommendation. Mail application to: Chair of Appointments Committee, Department of Mathematics-DRB 155, University of Southern California, Los Angeles, CA 90089-1113. USC is an Equal Opportunity/Affirmative Action Employer. Women and minorities are especially encouraged to apply.

WHITTIER COLLEGE Whittier, CA 90608

The Department of Mathematics invites applications for an anticipated tenure-track position at the assistant professor level to teach undergraduate mathematics courses beginning fall of 1994, pending final budgetary approval.

Qualifications: Ph.D. (completed or to be completed by the summer of 1994) in Mathematics, evidence of quality teaching, and potential for scholarly growth. Expertise in Applied Mathematics preferred. Most faculty at the college participate in teaching College-wide courses such as Freshman Writing Seminars and other interdepartmental courses.

Candidates should send a curriculum vitae, a statement of teaching philosophy, and three letters of recommendation to Chairperson, Department of Mathematics, Whittier College, P.O. Box 634, Whittier, California 90608.

Review of completed applications will begin on Feb. 15, 1994.

Whittier College is an Equal Opportunity/Affirmative Action Employer.

COLORADO

COLORADO SCHOOL OF MINES

The Colorado School of Mines is seeking candidates for the position of Head of the Department of Mathematical and Computer Sciences. This department offers B.S., M.S., and Ph.D. degrees under the department title. With a faculty of 18 tenured and tenure track members, the department receives annually approximately a million dollars in grants; 116 undergraduate students and 70 graduate students are currently enrolled in our degree program.

The position requires a Ph.D. in a mathematical or computer science. The applicant should have a sufficiently outstanding record of scholarly achievement and teaching experience to justify a tenured appointment at the Full Professor level. In addition, the successful

applicant must have held an academic position for at least five years, and show evidence of demonstrable administrative ability, including visionary leadership, communication skills, and effective interaction and evaluation of personnel. The Head is expected to manage and direct the department's efforts in instruction and in scholarship, to continue and enhance its excellence in teaching and in research, to plan and oversee the development of its research activities and academic programs, and to represent the department on campus and externally.

The Colorado School of Mines is a state university, internationally renowned in the energy, materials, and resource fields, attracting outstanding students in a broad range of science and engineering disciplines. The School of Mines is strongly committed to quality teaching and research. CSM provides an attractive campus environment, a collegial atmosphere, relatively small size (3000 student, about 30% in graduate programs), and an ideal location in the foothills of the Rocky Mountains 13 miles from downtown Denver.

Applications will be considered beginning February 15, 1994, and thereafter until the position is filled. The applicant should provide a statement giving administrative, pedagogical, and scholarly philosophy which should include a discussion of advantages and disadvantages of programs combining both Computer Science and Mathematics, and how to reconcile research vs. teaching conflicts. This letter and a vita should be sent by postal mail to the Colorado School of Mines, Department Head Search #94-01-31, 1500 Illinois Street, Golden, CO 80401. The applicant should also arrange for five letters of reference to be mailed to the above address or sent by e-mail to pmurphy@nitro.mines.colorado.ed.

CSM is an AA/EEO. Women and minorities are encouraged to apply.

CONNECTICUT

SOUTHERN CONNECTICUT STATE UNIVERSITY Mathematics Department

Tenure-track position at Assistant Professor rank beginning 8/22/94 to teach undergraduate/graduate mathematics education and mathematics, and supervise secondary school student teachers. Teaching load: 12 hours/sem. Salary range: \$32,677 to \$45,786. Qualifications: doctorate (or near completion) in mathematics or mathematics education with a strong mathematics background, evidence of quality teaching, potential for scholarly growth. Secondary school teaching experience preferred. Send letter of application, vita, transcripts (unofficial ok), three letters of reference to Dr. Robert Washburn, Chair, Search 93-269, Southern Connecticut State University, 501 Crescent St., New Haven, CT 06515. Full consideration given to applications received by 1/15/94. AA/EEO.

FLORIDA

FLORIDA INTERNATIONAL UNIVERSITY

The Department of Mathematics announces tenure track positions beginning August 1994. These positions are usually at the beginning Assistant Professor level. Candidates must have a Ph.D. in Mathematics and a commitment to research and quality teaching. Qualified candidates in all areas of Mathematics will be considered.

Teaching load consists of no more than five 3-credit courses per academic year. Send resume and arrange for 3 letters of recommendation to be sent to: Recruitment Committee, Department of Mathematics, Florida International University, Miami, FL 33199.

Florida International University is an equal opportunity/equal access employer. It is a member of the State University system of Florida, with approximately 24,000 students. The department offers bachelor's and master's degrees.

GEORGIA

DEKALB COLLEGE A Two-Year Unit of the University System of Georgia Dean Mathematics (Position Ref. 95-14)

Located on four campuses in suburban Atlanta, DeKalb College provides an attractive environment of learning for a motivated student body of 16,000 representing a wide range of cultures. The College has earned an exceptional reputation among two-year institutions for the quality of its teaching of liberal arts and sciences as well as professional career preparation.

The division dean serves in a college-wide capacity to ensure the effectiveness of the Mathematics curriculum in achieving the stated outcomes of the institutions's mission. She/he is responsible to the Vice-President for Academic Affairs and supervises all department heads in the Mathematics area.

Candidate must possess strong interpersonal and communication skills; knowledge of current trends in higher education; ability to initiate/manage a wide variety of activities with minimal direction; ability to work with a variety of groups, both inside and outside the college, to promote the college and its programs; ability to manage change and to negotiate resolutions to problems among groups with competing interests. A doctorate is required with a minimum of 18 semester (30 quarter) graduate hours in mathematics.

A minimum of three years administrative experience at the department head level or above is essential plus five years of full-time college teaching experience (preferably at the two-year college level). Salary: \$50,000+ (placement is commensurate with education and experience); excellent benefits. This is a twelve month, tenure track position with faculty rank beginning July 1, 1994.

Applications and nominations for the DEAN MATHEMATICS will be accepted until 1/28/94.

To be considered, please provide the following: (1) letter of application referencing position number (#95-14); (2) resume; (3) unofficial copies of graduate transcript(s); (4) names, addresses, and telephone numbers of three references.

Please submit requested documents in a single packet to: Judy Chastonay, DeKalb College, Personnel Dept., 3251 Panthersville Rd., Decatur, GA 30034. DeKalb College is an Equal Opportunity, Affirmative Action Employer which invites and encourages applications from minorities. Georgia is an Open Records State.

ILLINOIS

ILLINOIS INSTITUTE OF TECHNOLOGY Mathematics Department Chair

Applications are invited for a senior-level faculty appointment as department chair, starting August 1994. The department has 14 full-time faculty, and offers masters and doctoral degrees in mathematics, applied mathematics, and applied statistics.

The candidate should have a vital research program in an area that complements current departmental strengths. The chair is responsible for leading the development of all research and educational activities in the department.

Review of applications will begin in January 1994 and will continue until the position is filled. Candidates must be U.S. citizens or meet Immigration Reform Act criteria.

Send letter of application, curriculum vitae, and names of references to:

Search Committee
Department of Mathematics
Illinois Institute of Technology
10 West 32nd Street
Chicago, IL 60616

Phone: 312-567-3162; Fax: 312-567-3155

Illinois Institute of Technology is an Equal Opportunity/Affirmative Action University.

NORTHWESTERN UNIVERSITY Mathematics Department 2033 Sheridan Road Evanston, Illinois 60208-2730

The Mathematics Department will sponsor an Emphasis Year in dynamical systems. This program will include two-year assistant professorship positions starting September 1994 and possible visiting positions for more senior mathematicians for part or all of the academic year. Applications should be sent to Professor Clark Robinson at the department address and include a curriculum vitae and three letters of recommendation. In order to ensure full consideration, an application should be received by January 15, 1994. Northwestern University is an affirmative action, equal opportunity employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

THE UNIVERSITY OF ILLINOIS AT CHICAGO Department Head Department of Mathematics, Statistics, and Computer Science

The Department of Mathematics, Statistics, and Computer Science at the University of Illinois at Chicago seeks applicants for the position of Head. The Department enjoys an AMS Group I classification, and has 68 faculty and over 200 graduate students. Major research programs include applied mathematics, mathematical computer science, mathematics education, probability and statistics, and pure mathematics. Located in the heart of Chicago, UIC is a research university with 16,000 undergraduate, 5,000 graduate, and 3,000 professional students.

The Head is the chief administrative officer of the Department, with responsibility for instructional programs, administrative, budgetary, promotion, and recruitment matters. The Head is expected to provide leadership in the further development of research, teaching, and public service. The successful candidate will have an earned doctorate and be eligible for appointment at the rank of full professor. A strong record in research and university teaching, a demonstrated commitment to equality of opportunity, and substantial leadership and organizational skills are required. Women and minority candidates are especially encouraged to apply. The desired appointment date is August 21, 1994.

Applications should be received by February 1, 1994, to receive full consideration, although the search will proceed until the position is filled. Materials, including a full curriculum vitae and names and addresses of four references, should be directed to:

Professor Vera Pless
Search Committee for Department
Head
c/o College of Liberal Arts and
Sciences, m/c 228
The University of Illinois at Chicago
601 South Morgan Street
Chicago, Illinois 60607-7104

UIC is an Affirmative Action/Equal Opportunity Employer

WOLFRAM RESEARCH, INC. Mathematica Development

We are looking for more top quality mathematicians to join the *Mathematica* research and development team. We anticipate openings in several areas. Applicants should be able to work in a fast-paced environment and be capable of interacting well with mathematicians and others. Applicants should have a broad knowledge of mathematics. Applicants should have considerable programming experience: knowledge of *Mathematica* is required; experience with C is preferred. A Ph.D in mathematics (or equivalent experience) is required. Send resumes to: Attn: Personnel, Wolfram Research, Inc., 100 Trade Center Drive, Champaign, IL 61820 or resumes@wri.comm. AA/EEO

INDIANA

INDIANA UNIVERSITY-PURDUE UNIVERSITY AT INDIANAPOLIS (IUPUI)

Department of Mathematical Sciences

The Department of Mathematical Sciences at IUPUI is seeking applicants for two or more tenure-track positions to begin in August 1994. Rank is open depending on qualifications. Applicants must have an earned doctorate by the starting date. A strong research record or excellent research potential as well as a commitment to quality graduate and undergraduate teaching are required. Some preference may be given to applicants in scientific computing and applied statistics. However, strong applicants from all areas of mathematical sciences are encouraged to apply.

IUPUI is a comprehensive urban university with over 28,000 students. The department offers programs of study leading to Purdue University B.S., M.S., and Ph.D. degrees. The university offers competitive salaries and provides excellent fringe benefits. Send resume and three letters of recommendation to Prof. C. D. Aliprantis, Acting Chair, Department of Mathematical Sciences, IUPUI, 402 N. Blackford Street, Indianapolis, Indiana 46202-3216. Closing date: January 15, 1994. Late applications will be considered until positions are filled.

IUPUI is an Affirmative Action/Equal Opportunity Employer. Women and minority candidates are encouraged to apply.

KANSAS

KANSAS STATE UNIVERSITY Department of Mathematics

Subject to budgetary approval, applications are invited for tenure-track and visiting positions commencing August 18, 1994; rank and salary commensurate with qualifications. The Department seeks candidates whose research interests mesh well with current faculty. The Department has research groups in the area of analysis, algebra, geometry/topology, and differential equations. Although all fields will be seriously considered, some preference will be given to candidates in differential equations. Applicants must have strong research credentials and a commitment to excellence in teaching. A Ph.D. in mathematics or a Ph.D. dissertation accepted with only formalities to be completed is required. Letter of application, current vita, description of research, and three letters of recommendation should be sent to:

Louis Pigno
Department of Mathematics
Cardwell Hall 137
Kansas State University
Manhattan, KS 66506

It is expected that offers will begin on December 14, 1993, but applications for positions will be reviewed until February 1, 1994, or until positions are closed. AA/EEO

THE WICHITA STATE UNIVERSITY

The Department of Mathematics and Statistics invites applications for a tenure-eligible position starting August 1994. Special consideration will be given to persons having expertise in numerical analysis or geometric analysis. We seek someone whose research interests are consonant with those of our faculty. Senior candidates should have distinguished research records. Junior candidates are expected to have excellent research potential. All candidates should have a strong commitment to excellence in teaching and the ability to participate in and contribute to our doctoral program in Applied Mathematics. Salary and rank negotiable. Ph.D. in Mathematics is required. Women and minority candidates are especially urged to apply. Send application letter, detailed resume, and arrange to have three reference letters sent by January 20, 1994 (or monthly until the position is filled) to:

The Wichita State University
Professor Stephen W. Brady, Search
Committee Chair
Department of Mathematics and
Statistics
Wichita, Kansas 67260-0033
e-mail: brady@twsuvm.uc.twsu.edu
fax: 316-689-3748
AA/EOE

MAINE

BOWDOIN COLLEGE Brunswick, Maine 04011

Mathematics Department: Tenure-track Assistant Professorship in applied mathematics starting Fall 1994. Initial appointment for three years with renewal possible. Possibility of second, non-tenure-track position—field open. Ph.D. required and strong research record or potential expected. Normal teaching load is two courses per semester. Candidates with record of effective undergraduate teaching preferred. Review of candidates begins 1 January, but applications will be considered until position is filled. Send resume and 3 letters of recommendation to James E. Ward, Chair, Department of Mathematics, Bowdoin College, Brunswick, ME 04011. Include e-mail address. Bowdoin College is committed to equal opportunity through affirmative action. Women and members of minority groups are urged to apply and invited to identify themselves as such.

UNIVERSITY OF SOUTHERN MAINE

Assistant Professor

Department of Mathematics and Statistics

The University of Southern Maine invites applications for a tenure-track position at the rank of Assistant Professor starting in the Fall of 1994. Candidates without the Ph.D. completed at the time of application must accompany the application with a statement from the institution in which enrolled for doctoral studies confirming that the degree will be completed by August 1, 1994. Candidates must show potential for

productive research. Preference will be given to candidates with expertise in Algebra, Numerical Analysis, Mathematical Modelling, or a related field. We seek applicants with a strong commitment to teaching at both the undergraduate and graduate levels and an interest in innovative approaches to the teaching of mathematics. Women and minorities are encouraged to apply. Send letter of application, curriculum vitae, graduate transcripts, and three letters of recommendation to: Joel Irish, Chair, Department of Mathematics and Statistics, RE: 102, University of Southern Maine, 37 College Avenue, Gorham, ME 04038. USM is an EEO/AA employer. Review of applications will begin January 20, 1994, and continue until the position is filled.

MARYLAND

TEACH IN ASIA OR EUROPE

University of Maryland University College seeks excellent teachers for openings on U.S. military bases overseas. Appointments begin August 1994. Requirements include M.A. or Ph.D., recent college teaching experience, and U.S. citizenship. Competence to teach in another discipline desirable. Benefits include transportation and military base privileges (PX, commissary, etc.). Frequent travel and the cost of schooling make these positions difficult for those with children. Send resume to: Dr. Ralph E. Millis, Assistant to the President, Overseas Programs, University of Maryland University College, College Park, MD 20742-1642. AA/EEO.

MASSACHUSETTS

BOSTON UNIVERSITY

The Department of Mathematics at Boston University invites applications for a regular faculty position in the area of Algebra/Number Theory. The successful applicant should have a strong commitment to both research and teaching. Applications and at least three letters of recommendation should be sent to: Search Committee (Algebra and Number Theory), Department of Mathematics, Boston University, 111 Cummings St., Boston, MA 02215. AA/EEO.

COLLEGE OF THE HOLY CROSS

Worcester, Massachusetts

Tenure track appointment beginning in September 1994 is available for a Ph.D. mathematician interested in teaching at an undergraduate liberal arts college. Strong commitment to teaching and research is required. Preference will be given to candidates in the fields of global analysis, mathematical physics, differential topology, and geometry. Teaching load is three courses each semester. Salary is competitive. Fringe benefits include TIAA-CREF, medical, dental, and life insurance plans and generous sabbatical and faculty fellowship programs.

Holy Cross is an affirmative action/equal opportunity employer. Women and minorities are encouraged to apply. Applications, including re-

sume, undergraduate and graduate transcripts and three letters of recommendation evaluating teaching and scholarship should be sent to David B. Damiano, Chair. Deadline for Applications: February 1, 1994. Representatives of the Department will attend the Joint Mathematics Meeting in Cincinnati and will participate in the Employment Register. We expect to invite candidates to campus for interviews beginning in early February 1994.

TUFTS UNIVERSITY

Department: Mathematics

Contact Person: Todd Quinto,

Search Committee Chair

Address: Medford, MA 02155

Application Deadline: February 15, 1994

Applications are invited for one tenure-track position at the rank of Assistant Professor starting September 1, 1994. A Ph.D. in mathematics with specialization in numerical analysis is required. Applicants must show promise of strong research and will be expected to excel in teaching, especially at the introductory level. The teaching load will be two courses per semester. Please send a c.v. and have three letters of recommendation sent by February 15, 1994. As an Affirmative Action/Equal Opportunity Employer, Tufts encourages women and minority candidates to apply.

MISSOURI

NORTHEAST MISSOURI STATE UNIVERSITY

The following positions are expected to be available in August 1994: Tenure-track Assistant or Associate Professor of Mathematics Education, Tenure-track Assistant Professor of Statistics, Tenure-track Assistant Professor of Mathematics, and two or more temporary Instructor positions. Tenure-track positions require appropriate doctoral degree; Instructor positions require at least the Master's degree. Candidates for the Mathematics Education position should have teaching experience in secondary education and be qualified to supervise teaching interns. Substantial driving to internship sites required.

One tenure-track position and at least one temporary instructorship will involve teaching some or all statistics courses. Teaching loads are nine hours per semester for tenure-track positions, twelve for instructors. Candidates should supply evidence of potential for excellence in teaching, advising, research, and service appropriate for the position they seek. Experience with the use of technology in teaching desirable.

Complete applications consist of a letter of application, a statement of teaching philosophy, transcripts of undergraduate and graduate study, and three letters of reference. These should be sent to Dr. Lanny Morley, Division Head, Mathematics and Computer Science, Northeast Missouri State University, Kirksville,

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MO 63501. NMSU is an Equal Opportunity Employer.

NEBRASKA

UNIVERSITY OF NEBRASKA AT KEARNEY

Statistics: Tenure track position, Assistant or Associate Professor beginning Aug. 1994 to teach undergraduate and graduate courses, advise students, service/consulting. Ph.D. in statistics or a closely related area. Prefer applicants with emphasis in applied statistics, stat computing, and actuarial science. Strong commitment to excellence in teaching and scholarship essential. Productive research potential, strong interpersonal and communication skills. Interest in coordinating, integrating, and developing the statistics and actuarial science programs preferred. Salary commensurate with experience and education. The University provides Retirement Plan options and a flexible benefits program at a minimal cost to the employee. Review of applicants will begin February 14, 1994. Send letter of application describing experience and qualifications, transcripts, vita, and three letters of recommendation to Dr. Richard L. Barlow, Statistics Search Committee Chair, Dept. of Mathematics and Statistics, Univ. of Nebraska at Kearney, 68849-5360. EEO/AA.

NEVADA

UNIVERSITY OF NEVADA, RENO

The Department of Mathematics of the University of Nevada, Reno, has openings for two tenure-track positions "A" and "O" at the assistant professor level. Minimum qualifications for both positions are: a Ph.D. in a mathematical science; strong potential for significant research accomplishments; demonstrated excellence in teaching, including interest in incorporating instructional innovation and technology in the classroom; leadership potential and demonstrated interest in curricular and programmatic development at both the undergraduate and graduate level; ability to communicate and work effectively with students and faculty; and compatibility with the programmatic and research needs of the department.

For position "A" the department has particular needs in several areas of Applied Mathematics including Applied Logic, Computational Mathematics, Differential Equations, and Statistics; for position "O" the department has particular needs in the areas of Differential Geometry, Dynamical Systems, Harmonic Analysis, and Low-Dimensional Topology. Candidates with expertise in one or more of these areas are especially encouraged to apply. For both positions, excellence of qualifications will be given greater weight than field of specialization. AA/EEO. Women and Minorities are especially encouraged to apply.

Send application specifying the position(s) applied for by the application deadline of February 15, 1994, with your vita and three letters of recommendation to: Dr. Chaitan Gupta, Chair, Department of Mathematics, University of

Nevada, Reno, Reno, NV 89557. Please include the AMS classification number(s) of your field of specialization, if possible.

NEW HAMPSHIRE

DARTMOUTH COLLEGE

John Wesley Young Research Instructorship in Mathematics

The John Wesley Young Research Instructorship is a two year postdoctoral appointment for promising new or recent Ph.D.s whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, combinatorics, computer science, differential geometry, logic and set theory, number theory, probability and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's speciality and include elementary, advanced, and (at instructor's option) graduate courses. Nine-month salary of \$34,000 supplemented by summer (resident) research stipend of \$7,556 (two-ninths). Send letter of application, résumé, graduate transcript, thesis abstract, description of other research activities and intersects if appropriate, and 3 or preferably 4 letters of recommendation (at least one should discuss teaching) to Phyllis A. Bellmore, Mathematics and Computer Science, 6188 Bradley Hall, Hanover, NH 03755-3551. Applications received by Jan. 15 receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to affirmative action and strongly encourages applications from minorities and women.

NEW JERSEY

RUTGERS UNIVERSITY-NEWARK Assistant Professor of Mathematics

The Department of Mathematics and Computer Science invites applications for an anticipated tenure-track Assistant Professor position beginning September 1994. Candidates must have a Ph.D., have a strong research record, and be able to demonstrate outstanding promise, as well as a commitment to effective teaching. Preference will be given to candidates with research interests in one or more of the following areas: algebraic geometry, representation theory, automorphic forms, and number theory.

Applicants should arrange for a curriculum vitae and at least four letters of recommendation, including one which addresses teaching, to be sent to Mark Feighn, Associate Chair, Department of Mathematics and Computer Science, Rutgers University, Newark, NJ 07102. Responses may also be e-mailed to math@andromeda.rutgers.edu. Processing of applications will begin January 15, 1993.

Rutgers University is an equal opportunity/affirmative action employer.

TRENTON STATE COLLEGE Department of Mathematics and Statistics Anticipated Faculty Vacancies for Fall 1994

Tenure track positions at the Assistant Professor level: Req'd: Doctorate in Mathematics Education, Statistics, or Mathematics; demonstrated commitment to quality teaching; strong research potential. All fields will be considered; openings are anticipated in Mathematics Education as well as in Statistics and Mathematics.

Send vita and three letters of recommendation to:

Aigli Papantonopoulou, Chair
Search Committee
Dept. of Mathematics and Statistics
CN 4700 Hillwood Lakes
Trenton, NJ 08650-4700.

The review process will begin February 1, 1994, and will continue until all the positions are filled. Non-U.S. citizens must include a statement of current visa status.

The department currently enrolls over two hundred and fifty majors in Mathematics, Mathematics Education, and Statistics. A graduate program offers a master's degree in mathematics and in mathematics education.

To enrich education through diversity, TSC is an AA/EEO.

NORTH CAROLINA

UNIVERSITY OF NORTH CAROLINA-CHARLOTTE Mathematics Department Charlotte, NC 28223

Two tenure-track positions at the Assistant Professor level—one in Mathematics Education and one in any area of Mathematics. The Department's major strengths are in the areas of Statistics, Applied Mathematics, Probability, PDEs, Numerical Analysis, Operator Theory, Algebra. Visiting positions and Postdoc Positions are also available. Ph.D. and serious commitment to teaching and research required for all positions. The applicant should send vita and a short abstract of current research interest and should indicate which position and at what rank for which she/he wishes to be considered. Females are especially encouraged to apply. Address to Professor R. F. Anderson at the above address. The applicant should also arrange for 4 letters of reference, addressed to Professor Anderson. For full consideration, applications should be submitted by January 28, 1994; otherwise, applications will be accepted until positions are filled.

UNCC IS AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITY EMPLOYER.

WAKE FOREST UNIVERSITY Department of Mathematics and Computer Science

Applications are invited for a position as Instructor or Visiting Assistant Professor in Mathematics. The term is one year, renewable for up to three years. Rank is dependent upon

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qualifications, and a Master's or Ph.D. degree in Mathematics or Statistics is required. Duties consist only of teaching three courses per semester. A strong interest and preparation for teaching calculus and introductory statistics is desirable. The department has 22 members, offers a B.S. and M.A. in mathematics, and a B.S. and M.S. in computer science. Send a letter of application and résumé to Richard D. Carmichael, Chairman, Department of Mathematics and Computer Science, Wake Forest University, Box 7388, Winston-Salem, NC 27109. AA/EO employer.

WAKE FOREST UNIVERSITY Department of Mathematics and Computer Science

Applications are invited for a position as Instructor or Visiting Assistant Professor in Mathematics. The term is one year, renewable for up to three years. Rank is dependent upon qualifications, and a Master's or Ph.D. degree in Statistics or Mathematics is required with preference being given to holders of a statistics degree for this position. Duties consist only of teaching three courses per semester. A strong interest and preparation for teaching introductory statistics and calculus is desirable. The department has 22 members, offers a B.S. and M.A. in mathematics, and a B.S. and M.S. in computer science. Send a letter of application and résumé to Richard D. Carmichael, Chairman, Department of Mathematics and Computer Science, Wake Forest University, Box 7388, Winston-Salem, NC 27109. AA/EO employer.

OHIO

BOWLING GREEN STATE UNIVERSITY Department of Mathematics and Statistics Bowling Green, OH 43403-0221

Assistant Professor, Tenure-Track

The Department anticipates two tenure-track positions and encourages applications in: Mathematics Education, Functional/Applied Analysis (Approximation Theory, Banach Spaces, Operator Theory, Optimization, PDEs and Scientific Computation) and Probability and Stochastic Processes. We have 31 faculty, 70 full-time graduate students, and a growing doctoral program (23 Ph.D.s awarded in the last five years). The selected candidate, who must have a Ph.D., will be expected to pursue research, teach two courses per semester, work with graduate students, and eventually have the opportunity to direct Ph.D. dissertations. Those with postdoctoral experience are encouraged to apply. Candidates are expected to have a strong research record (or potential) in an area compatible with current faculty. Salary Competitive. Please provide vita, publication list, official transcript, and have three letters of recommendation (one concerning teaching) sent by February 1, 1994, to:

Professor A.M.W. Glass, Chair
Department of Mathematics and
Statistics

Bowling Green State University
Bowling Green, OH 43403-0221 USA
Equal Opportunity Employer: Women and
minorities are encouraged to apply.

CLEVELAND STATE UNIVERSITY Assistant Professor in Mathematics

The Mathematics Department invites applications for a tenure track position at the Assistant Professor level. Candidates must have completed a Ph.D. in a mathematical science by the starting date and must have demonstrated a commitment to excellence in both teaching and research. Applicants must have research specialization in one of the following areas: applied statistics, applied probability, stochastic processes, numerical analysis, wavelet theory. Applicants should arrange to have a vita and three letters of recommendation sent to Professor John J. Walsh, Department of Mathematics, Cleveland State University, Cleveland, OH 44115. (Funding for this position is pending.) Starting Date: September 19, 1994. Salary: competitive. Deadline for applications: February 4, 1994. Minorities, women, and handicapped are particularly encouraged to apply. Cleveland State University is an Equal Opportunity/Affirmative Action Employer.

DENISON UNIVERSITY

The Department of Mathematical Sciences anticipates a two-year position with the possibility for renewal at the level of Assistant Professor starting in Fall 1994. Eventual conversion to tenure-track is likely. A doctorate (or ABD) in mathematics is required. Ability to teach statistics or "computer literacy" courses a plus, but not required. A commitment to quality undergraduate instruction is essential. Duties include teaching three courses per semester and continued scholarship.

Denison is a liberal arts college of about 1900 students located in a village of about 4000, twenty-five miles east of Columbus. The department offers B.A. and B.S. degrees in mathematics and in computer science. The department consists of nine full-time members.

Send resume, transcripts of graduate work, and three letters of recommendation (at least one should address your teaching) to Professor Todd Feil, Chair, Department of Mathematical Sciences, Denison University, Granville, Ohio 43023.

Applications should be made by February 1, 1994; applications beyond this date will be considered until the position is filled. Denison is an Affirmative Action/Equal Opportunity Employer; women and minorities are encouraged to apply.

THE OHIO STATE UNIVERSITY Mansfield Campus

Tenure-track assistant professorship in mathematics. Ph.D. required. Preference for candidates specializing in algebraic geometry or Lie algebras. Strong commitment both to undergraduate teaching and to math research is

essential. The successful candidate will hold rank in the Ohio State University's Department of Mathematics. To apply, send letter, vita, and 3 letters of reference to Dr. Gary Kennedy, OSU Mansfield, 1680 University Drive, Mansfield OH 44906. To ensure full consideration, arrange for all materials to arrive by February 15, 1994. The Ohio State University is an equal opportunity/affirmative action employer. OSU Mansfield has identified diversity of its faculty, staff, and students to be a very important goal. Qualified women, minorities, Vietnam-era veterans, and individuals with disabilities are encouraged to apply.

OKLAHOMA

SOUTHEASTERN OKLAHOMA STATE UNIVERSITY Faculty Position Announcement

DEPARTMENT CHAIR OF MATHEMATICS: Ph.D. required. Administrative skills necessary. Rank is negotiable. Teaching load is six hours per semester. Applicants must have demonstrated scholarship and at least five years teaching and/or administrative responsibilities.

ASSISTANT PROFESSOR/INSTRUCTOR: Applicant must possess either Ph.D. in Mathematics (Assistant Professor rank, tenure track) or must be an ABD (Instructor rank). Duties include teaching undergraduate mathematics at all levels, student advising, scholarly activities, and committee service.

To apply, submit a letter of application, resume, official transcripts, statement of administrative/academic philosophy or teaching philosophy, and three letters of recommendation to Southeastern Oklahoma State University, Personnel Office, Station A, Durant, OK 74701. Minorities and women are especially encouraged to apply. Application deadline is February 7, 1994. EOE/AA

PENNSYLVANIA

BIostatistician

Seeking an individual to work in Spring House, PA, to be involved in the development and implementation of statistical analysis plans for preclinical and clinical research, analyzing results and writing statistical reports according to the Standard Operating Procedures of the employer. Individual will work closely with pre-clinical and clinical staff on the design of studies for projects in different therapeutic areas. Qualified applicants must possess a Ph.D. in Statistics and three years experience as a Statistician, at least two of which must be in the field of Biostatistics. Applicants must possess a knowledge of pharmacokinetic/pharmacodynamic analysis, SAS and FORTRAN Programming, familiarity with VAX and PC. Applicants must have the ability to design statistical protocols. Annual salary \$58,500. Submit resume or C.V. to the Philadelphia Job Bank, 444 N. 3rd St., 3rd Fl.,

Classified Advertisements

Philadelphia, PA 19123. Job2 Order Number 4542207.

CARNEGIE MELLON UNIVERSITY Department of Mathematics

The Department of Mathematics anticipates the appointment of tenured or tenure-track faculty members beginning September 1, 1994. We are particularly interested in applicants in the areas of applied analysis and numerical analysis. Some visiting positions may also be available. Applicants should send a vita, list of publications, and a statement describing current and planned research, and arrange to have three letters of recommendation sent to: Appointments Committee, Department of Mathematics, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

SAINT JOSEPHS UNIVERSITY Philadelphia, PA 19131

The Department of Mathematics and Computer Science seeks applicants for a one year replacement of a faculty member on leave for 1994-1995. Candidates should be willing to teach courses at all levels of the undergraduate curriculum. Applications with three letters of recommendation should be sent to Dr. J.P.E. Hodgson at the above address. Applications should be received by February 15th in order to guarantee consideration.

PUERTO RICO

THE UNIVERSITY OF PUERTO RICO AT MAYAGUEZ Department of Mathematics

[Please note: The previous version of this ad ran with an error. The sentence "Fluency in spoken and written Spanish or English..." should have said "Fluency in spoken and written Spanish AND English..."] The Department of Mathematics has a tenure-track opening for an Instructor in the area of applied mathematics (with emphasis in optimal control), with a salary of \$21,000 per year. Fluency in spoken and written Spanish or English, a Master's degree in mathematics, and one year of academic experience are required. The appointee will be expected to teach undergraduate courses and do research.

Send resume and three letters of recommendation to:

Prof. Yuri Rojas-Ramirez
Acting Chairperson
Department of Mathematics-UPR
P.O. Box 5000
Mayaguez, Puerto Rico 00681-5000
EEQ/AA

TENNESSEE

VANDERBILT UNIVERSITY Department of Mathematics Nashville, TN 37240

We invite applications for a Distinguished or Named Professor position beginning Fall 1994. This is a tenured position and we are seeking a specialist in algebra with outstanding research credentials. The interests of our algebra group include universal algebra and lattice theory, set-theoretic algebra, abelian groups, semigroups, ring theory, and logic with applications to computer science. Evidence of effective teaching is required. To apply, send the following materials in a single mailing to Professor Constantine Tsinakakis, Chair, at the address above: letter of application (with e-mail address if available) and a curriculum vitae with a list of publications. Additional information, including letters of recommendation, will be requested from selected candidates after the initial screening. Only solicited letters of recommendation will be considered.

VANDERBILT UNIVERSITY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

TEXAS

TEXAS A&M UNIVERSITY-KINGSVILLE

Subject to availability of resources and administrative approval, at least one tenure track position at the Assistant Professor level will be available beginning with the Fall Semester 1994. Applicants must have a Ph.D. in Mathematics and show evidence of good teaching ability, excellent communication skills, and tangible evidence of scholarly activity. We are seeking persons who can take an active role in teaching and curriculum development in support of our undergraduate and graduate programs in Mathematics, Statistics, and the training of teachers of Mathematics. Candidates with strong backgrounds in applied mathematics and/or Complex Analysis will be given first consideration. Teaching assignments will include lower level service courses. Salary is commensurate with experience. Send résumé, transcript, and three letters of recommendation to:

Faculty Search Committee
Department of Mathematics
Campus Box 172
Texas A&M University-Kingsville
Kingsville, TX 78363-8201

Completed applications received by February 1, 1994, will be given first consideration. Texas A&M University-Kingsville is part of the Texas A&M University System and is an equal opportunity/affirmative action employer.

UNIVERSITY OF TEXAS AT ARLINGTON Department of Mathematics

The Department invites applications for possibly two to three anticipated tenure-track positions

beginning with the Fall Semester 1994. We seek candidates in various areas of Mathematics which are complementary to those of the current faculty and would enhance and support the goals of the Department. Application deadline is February 15, 1994, or until positions filled. Salary and rank are commensurate with qualifications which must include the Ph.D. degree (in hand or expected by Sept. 1994). Assistant Professor candidates must show strong potential for excellence in teaching and research. For an Associate or Full Professorial appointment the candidate must have excellent teaching credentials and a nationally established research record; some success in attracting outside funding is preferred. Please send a resume and three letters of recommendation to:

Chairman
Recruiting Committee
University of Texas at Arlington
Department of Mathematics
Box 19408
Arlington, TX 76019-0408

The University of Texas at Arlington is an Affirmative Action/Equal Opportunity Employer.

UTAH

UNIVERSITY OF UTAH

University of Utah, Department of Mathematics, invites applications for the following positions. Availability of positions is contingent upon funding.

1. One full-time tenure track appointment on the professorial level in mathematics applicable to materials science. Applicants must have received their Ph.D. degrees prior to 1993. Selection will be based on research and teaching ability.

2. One C. R. Wylie Instructorship. The term of this instructorship is one year, but it may be renewed for up to three years. It will be awarded either to an incoming Instructor or to one of the Instructors already in residence on the basis of ability and potential in teaching and research. The stipend is \$38,000. Duties consist of teaching four courses during the three quarter academic year.

3. One or more visiting faculty positions of one year or less in any of the professorial ranks. Selection will be based on potential contributions to the department's research program and on teaching ability.

Applications for all positions will be accepted until January 31, 1994, or until all positions are filled.

Applications for any of these positions should include curriculum vitae, bibliography, and three letters of reference. (Instructorship applications should also include an abstract of the thesis and either a list of graduate courses completed or a transcript of graduate work.) Visiting faculty applications should indicate the portion of the three-quarter academic year during which the applicant wishes to visit. Please send your application to Committee on Staffing, Department of Mathematics, 233 JWB, University of Utah, Salt Lake City, Utah 84112. The University of Utah is an Equal Opportunity, Affirmative Action Employer and encourages applications from

women and minorities, and provides reasonable accommodation to the known disabilities of applicants and employees.

VERMONT

UNIVERSITY OF VERMONT Position in Mathematics

The Department of Mathematics and Statistics solicits nominations and applications to fill a 2-year Visiting Assistant Professor position in mathematics for the academic years 1994-95 and 1995-96. Applicants should have a Ph.D. in Mathematics and demonstrated excellence in research and teaching. Strong preference will be given to researchers in algebraic number theory, arithmetic algebraic geometry, and computational number theory who will contribute to the activities of the ongoing Quebec-Vermont Number Theory Seminar. Duties include teaching two courses per semester and conducting research. Applicants should send a vitae, description of research, and three letters of reference to: David Dummit, Personnel Committee, Department of Mathematics and Statistics, University of Vermont, Burlington, VT 05401-1455. Applications will be processed starting February 1, 1994; duties begin in the fall semester 1994. UVM is an Equal Opportunity/Affirmative Action Employer. Members of underrepresented groups are strongly encouraged to apply.

WISCONSIN

UNIVERSITY OF WISCONSIN-PARKSIDE

The Department of Mathematics invites applications for an anticipated tenure-track assistant professorship to begin in fall 1994. Excellence in mathematical research is required, as well as a serious commitment to excellent teaching of undergraduate mathematics, including elementary algebra, to an increasingly diverse student population. The ability to interact with research of current faculty will be positively considered; these areas include infinite and combinatorial group theory, ring theory and enveloping algebras, low-dimensional topology and set theory. Teaching duties are 9-10 hrs/wk. Women and minorities are encouraged to apply. Applications, including at least three letters of reference, should be sent to Professor A. M. Brunner, Department of Mathematics, University of Wisconsin-Parkside, Box 2000, Kosonsha, WI 53141-2000. Review of applications will commence February 12, 1994. UW-Parkside is an Equal Opportunity/Affirmative Action Employer.

WYOMING

UNIVERSITY OF WYOMING Department of Mathematics Tenure-Track Position in Algebra

The Department of Mathematics at the university of Wyoming seeks to hire an algebraist in a tenure-track position at the rank of assistant

professor. The candidate should have a Ph.D. and an established research record in the representation theory of finite groups and algebras, including Lie algebras, and must have strong teaching credentials. The candidate must also demonstrate an interest in working with our existing research group in algebraic combinatorics. The Department also has active researchers in analysis, applied mathematics, and mathematics education. The availability of this position is subject to administrative approval.

Complete applications consist of a vita, a list of publications, a summary of research interests, and three letters of recommendation sent directly to Professor Myron B. Allen, Chair, Department of Mathematics, University of Wyoming, Laramie, WY 82071-3036. Completed applications received by 1 January 1994 receive first consideration. Women and minorities are encouraged to apply. The University of Wyoming is an affirmative action/equal opportunity employer.

UNIVERSITY OF WYOMING Department of Mathematics Tenure-Track Position in Analysis

The University of Wyoming Mathematics Department invites applications for a tenure-track position in Analysis at the rank of assistant professor starting August 1994. Applicants must demonstrate strong ability in research, breadth of mathematical knowledge, interest in collaboration with mathematicians in other areas, strong commitment to high quality undergraduate and graduate teaching, and willingness to supervise masters and doctoral students. Preference will be given to researchers with strength in the areas of nonlinear functional analysis and PDE. Outstanding candidates in other areas of analysis are also encouraged to apply. The availability of the position is subject to administrative approval. The Mathematics Department has 25 full-time faculty in applied mathematics, algebra/combinatorics, analysis, and mathematics education.

Complete applications consist of a vita, a list of publications, a summary of research interests, and three letters of recommendation sent directly to Professor Myron B. Allen, Chair, Department of Mathematics, University of Wyoming, Laramie, WY 82071-3036. Completed applications received by 1 January 1994 receive first consideration. Women and minorities are encouraged to apply. The University of Wyoming is an affirmative action/equal opportunity employer.

CANADA

UNIVERSITY OF TORONTO Department of Mathematics

The Department solicits applications for a tenure-stream appointment in Analysis. Preference will be given to researchers in the areas of nonlinear analysis and geometric analysis.

The appointment is at the Erindale campus at the level of Assistant Professor to begin July 1, 1994. Candidates are expected to have at

least three years experience in teaching and research after the Ph.D. and to be able to demonstrate excellence in each. In particular, a candidate's research should show clearly the ability to make significant original and independent contributions to Mathematics. Salary commensurate with qualifications.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, and all appropriate material about their teaching. They should also arrange to have at least four letters of reference sent directly to Professor K. Murty, Associate Chair, Department of Mathematics, University of Toronto, Toronto, Canada M5S 1A1. At least one letter should be primarily concerned with the candidate's teaching. To insure full consideration, this information should be received by January 31, 1994.

In accordance with its Employment Equity Policy, the University of Toronto encourages applications from qualified women or men, members of visible minorities, aboriginal peoples, and persons with disabilities.

UNIVERSITY OF WATERLOO Department of Pure Mathematics

The Department of Pure Mathematics at the University of Waterloo invites applications for a tenure-track position at the Assistant Professor level starting July 1, 1994. The Department is particularly interested in candidates whose research interests are related to Algebraic Topology, Differential Geometry, Functional Analysis, or Number Theory. In order to be considered for the position, a Ph.D. is required. An appointment will be offered only to someone with very strong research and teaching qualifications. The University of Waterloo is committed to increasing the number of its female faculty, and therefore applications from women mathematicians are particularly welcome. Duties will include research, and teaching at all levels. Salary will depend on the candidates's qualifications. The closing date for applications is January 15, 1994. An application should contain the curriculum vitae of the candidate plus three letters of reference sent directly from the referees. In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. The University of Waterloo encourages applications from qualified women and men, members of visible minorities, native peoples and persons with disabilities. The availability of this position is subject to budgetary approval. Please send applications to: Dr. J. W. Lawrence, Chair, Department of Pure Mathematics, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1.

YORK UNIVERSITY Faculty Position in Discrete Mathematics

Subject to budgetary approval, applications are invited for a tenure-track appointment at the Assistant Professor level in the Department of Mathematics and Statistics, to commence July 1, 1994. The successful candidate will be

expected to have a strong established research record in Discrete Mathematics. Preference will be given to Combinatorics or Graph Theory. Applicants must have a completed Ph.D. and proven teaching abilities.

Applicants should send resumes and arrange for at least three letters of recommendation to be sent so that they arrive before January 24, 1994, directly to: Georges Monette, Chair, Department of Mathematics and Statistics, York University, 4700 Keele Street, North York, Ontario, M3J 1P3, Canada, FAX: 416-736-5757; e-mail: mathstat@mathstat.yorku.ca. York is implementing a policy of employment equity, including affirmative action for women faculty. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada.

ENGLAND

UNIVERSITY OF WARWICK Mathematics Institute E. C. Zeeman Research Fellowship in Mathematics

Applications are invited for the first E. C. Zeeman Research Fellowship in Mathematics. The position is available from October 1, 1994, and is tenable for three years.

Applicants may have research interests in any branch of mathematics. They must be within two years of completing their Ph.D. thesis on October 1, 1994; apart from this there are no other restrictions on potential applicants.

The salary will be on the Research Assistant Scale £12,828, to £20,442 at age-for-wage plus three additional increments (to reflect the prestigious nature of the Fellowship).

The successful applicant will be expected to do no more than three hours teaching per week, and this may be entirely at postgraduate level.

Applicants must submit a summary of their research interests, a research plan (one side of A4 maximum), and a curriculum vitae. They must arrange for two letters of recommendation to be sent directly to the address below. Applicants are invited to submit in addition one or more pieces of recent work (for example, Ph.D. thesis, preprints, papers).

The closing date for applications is: **31 March 1994.**

Address for correspondence:
E. C. Zeeman Fellowship in
Mathematics
Mathematics Institute
University of Warwick
Coventry CV4 7AL
U.K.

SWITZERLAND

SWISS FEDERAL INSTITUTE OF TECHNOLOGY (ETHZ)

The Swiss Federal Institute of Technology in Zurich (ETHZ) invites applications for the position of an Assistant Professor of Mathematics.

Duties of the new professor include research as well as an active participation in undergraduate and graduate courses for students of mathematics, natural sciences, and engineering. Candidates should have a university degree and successfully completed own research work. Willingness to teach at all university levels and to cooperate with colleagues is expected. The positions of assistant professors have been established to promote the career of younger scientists. They are available for three years in the first instance, with the possibility of a renewal for an additional three years.

Applicants with curriculum vitae and a list of publications should be submitted no later than **February 15, 1994**, to the President of the ETH Zurich, Prof. Dr. J. Nüesch, ETH Zentrum, CH-8092 Zurich. The ETHZ specifically encourages female candidates to apply with a view towards increasing the proportion of female professors.

UNIVERSITY OF ZÜRICH Professor of Mathematics

Applications are invited for two positions as **Professor of Mathematics** at the University of Zürich, one in Analysis and on in Numerical Analysis. Applicants are expected to be active in research and to be willing to participate in teaching at all levels.

Applications, including CV and list of publications, should be sent to Professor G. Rasche, Dekan der Philosophischen Fakultät II, Universität Zürich-Irchel, Winterthurerstrasse 190, CH-8057 Zürich, to arrive before 15th February 1994.

TAIWAN

NATIONAL TAIWAN UNIVERSITY Department of Mathematics

The Department of Mathematics invites applications for a tenure-stream appointment in Applied Mathematics. Strong consideration will be given to, but not limited to, the following areas: large-scale scientific computing, partial differential equations, numerical analysis, mathematical biology, fluid mechanics.

Applicants should send vita, three letters of recommendation, and brief description of

his/her research plan to: Professor Hai-Chau Chang, Chairman, Department of Mathematics, National Taiwan University, Taipei, Taiwan, R.O.C.. FAX: 886-2-391-4439. E-mail inquiries should be sent to Professor I-Liang Chern at chern@math.ntu.edu.tw. Applications completed by February 15, 1994, will receive first consideration. The National Taiwan University is an equal opportunity employer.

POSITION WANTED

Research Mathematician. Ph.D. 1984. Full Prof. 1992 Institute of Mathematics, Ukrainian Academy of Sciences. Specialty: Approximations and Expansions, Theoretical Computer Sciences, Functional Analysis. Other interests: Fourier Analysis. Available now. Alexander Kushpel, c/o 7131 - 136 Avenue Edmonton, AB. T5C 2K3 CANADA.

PUBLICATIONS FOR SALE

MATH SCI PRESS, 53 Jordan Rd., Brookline, MA 02146; 617-738-0307. **Lie-Cartan-Ehresmann Theory; Constrained Mechanics and Lie Theory; Geometric Structures in Nonlinear Physics**, by R. Hermann, \$95 each.

PUBLICATIONS WANTED

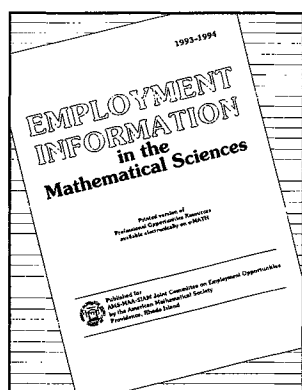
Wanted: Mathematical books, journals, reprints, ephemera. Contact R. K. Dennis, Math. Dept., White Hall, Cornell U., Ithaca, NY 14853-7901. Tel: 607-255-4027, FAX: 607-255-7149. e-mail: dennis@math.cornell.edu

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e-math.ams.org), electronically by e-MATH, or by mailing to EIMS, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248.

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University of Minnesota

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The Geometry Center is the NSF Science and Technology Research Center for Computation and Visualization of Geometric Structures. The Center has created a unified computing environment centered on math and supporting:

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Postdoctoral Research Fellowships

Up to three fellowships will be awarded for the academic year 1994-95 to individuals who have received their Ph.D. within five years of their starting date. They are for one year with the possibility of a one year renewal by mutual agreement.

Remuneration will be \$40,000/12 months if there is no other support. Applicants are expected to

demonstrate a high level of research accomplishment in mathematics or computer science, and to be at home in a computing environment.

Postdocs are expected to maintain a vigorous program of independent research. They are also expected to participate fully in the life of the Center, that is, to participate in ongoing or to initiate new activities in a combination of technology development, education, and outreach.

Center postdocs may participate in the scientific activities of the University's Computer Science and Mathematics departments, as well as the IMA and other institutes and centers at the University.

To apply please send 1) your vita, 2) a summary of your research accomplishments, 3) information concerning your computing experience, in particular details of major programs you have written, and 4) a research plan, indicating how you plan to make use of computing and graphics resources. In addition, 5) please list at least three references who are familiar with your work and whom you have asked to send separately letters of recommendation.

Applications from those with full or partial external support are strongly encouraged.

Application materials should be sent by February 28, 1994 preferably by email to *postdoc_appl@geom.umn.edu*, or by surface mail to Postdoc Applications at the address below.

Research Professorships

A very limited number of positions to supplement sabbatical support may be available to those with substantial research accomplishments for all or part of the academic year 1994-95. The salary will be at the rate of \$30,000/9 months or that which brings the sabbatical salary up to the full salary, whichever is less. To apply please send by February 28, 1994 a resume, and proposed research directions for the period of residence, including a detailed statement of how they will involve the computational and graphics resources of the Center. One or more letters sent on your behalf are also invited but not required.

Please send the application materials preferably by email to *res_appl@geom.umn.edu*, or to Professor A. Marden at the address below.

The Geometry Center
University of Minnesota
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SPECIAL BOOK OFFER

COMPUTATIONAL MECHANICS, INC., publisher of books in engineering and numerical methods, is pleased to offer the members of the American Mathematical Society a 25% discount on all titles. Below are descriptions of a small sampling.

Boundary Elements: An Introductory Course (2nd ed.)

C.A. Brebbia and J. Dominguez

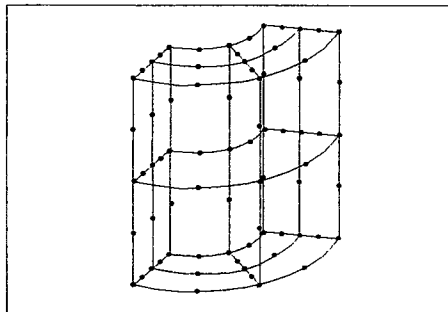
This best selling textbook has been written to provide a simple and up-to-date introduction to the Boundary Element Method. It is based on the authors' long experience teaching this numerical analysis method. The book has been written in a form enabling it to be used as a text book at undergraduate or graduate level as well as by the engineer in practice who wants to learn the fundamentals of the technique. Of particular interest is the way in which boundary element concepts are introduced and applied in simple - but useful - computer codes. These codes (four for potential and two for elasticity) facilitate comprehension of boundary elements. An introductory chapter explains why boundary elements are needed, and their advantages compared with finite elements in the solution of many engineering problems. Other chapters deal with potential problems, elastostatics, combination with finite elements and other topics of interest.

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ISBN: 1562520873

January, 1992 322 pp book ~~\$59.95~~ \$44.93
disk ~~\$48.00~~ \$36.00



Computational Stochastic Mechanics

A.H-D. Cheng, C.Y. Yang (eds.)

This book discusses the computational aspects of the application of stochastic techniques in the analysis of engineering mechanics problems. It covers research in fields where computational stochastic techniques have reached a level of considerable sophistication, and those of an exploratory and pioneering nature.

The book is divided into two parts: Theory and Computational Methodology, and Engineering Application. It includes applications in structural dynamics and reliability, fatigue and fracture mechanics, water waves, soil dynamics, earthquake and wind engineering, geacoustics, composite materials, shape design and identification, reliability design of dam-reservoir systems, groundwater flow, contaminant transport, among others. It also covers a few unconventional topics such as chaotic dynamics and fuzzy sets.

ISBN: 1562521748

October, 1993 750pp ~~\$304.00~~ \$228.00

Advanced Formulations in Boundary Element Methods

M.H. Aliabadi, C.A. Brebbia (eds.)

The boundary element method is now being increasingly applied to new topics in engineering. This has led researchers to investigate and develop new formulations of the method which lend themselves better to problems such as fracture mechanics, coupling with finite elements, moving boundary applications and non-linear problems. This book presents new boundary element formulations which are now emerging as viable alternatives for a wide range of complex problems.

ISBN: 156252111X

December, 1992 300pp ~~\$160.00~~ \$120.00

Applied Differential Equations for Scientists and Engineers

M. Rahman

These two volumes present a clear and well organized treatment of the concepts behind the development of mathematics. The text material is presented in a highly readable, mathematically solid format. Many practical problems have been illustrated displaying a wide variety of solution techniques. The volumes are intended for undergraduate mathematics courses for engineering students. Graduate students in mathematical and physical sciences can also use them towards their degree programs.

ISBN: 1562520563

November, 1991 2 vols. ~~\$210.00~~ \$157.50

Ordinary Differential Equations Volume 1

ISBN: 1562520571

November, 1991 656pp ~~\$140.00~~ \$105.00

Partial Differential Equations Volume 2

ISBN: 156252058X

November, 1991 356pp ~~\$73.00~~ \$54.75

Adaptive Finite and Boundary Element Methods

C.A. Brebbia, M.H. Aliabadi (eds.)

In recent years increasing attention has been paid to adaptive meshing and analysis techniques in order to improve the reliability of numerical analysis techniques such as the finite and boundary element method. This book presents a comprehensive review of the current state of adaptive analysis in engineering computation. As such the topics are wide ranging and include algorithms for automatic meshing, adaptive improvements, error analysis and adaptive solution procedures.

ISBN: 1562521144

November, 1992 380pp ~~\$160.00~~ \$120.00

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THE UNIVERSITY OF ARIZONA

Department of Mathematics and Program in Applied Mathematics

The Department of Mathematics at the University of Arizona offers a broad spectrum of graduate courses and seminars in algebra, analysis, applied mathematics, geometry, mathematical physics, probability, and mathematics education that lead to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy with majors in mathematics. Some course work outside the Department of Mathematics is required for each of these degrees. Both master's degrees require a thesis and can serve as a basis for further study toward a Ph.D. degree. Highly flexible programs in pure, and applications-oriented mathematics and mathematics education are offered in the Ph.D. program in mathematics. Completion of course work in major and minor fields and a dissertation presenting the student's original research are required.

In addition, the interdisciplinary Program in Applied Mathematics offers courses of study leading to the degrees of Master of Science and Doctor of Philosophy with majors in applied mathematics. Students entering the Program in Applied Mathematics take a one-year sequence of mathematics courses tailored to the needs of applied mathematics. Beyond this, the program offers great flexibility. Both M.S. and Ph.D. candidates are required to complete a certain number of courses outside the mathematics department. Ph.D. students complete a dissertation embodying original research under the direction of a member of the Program faculty. These faculty are 43 in number and have appointments in more than twenty departments of the University. The highly interdisciplinary faculty membership is a distinguishing feature of the Program in Applied Mathematics.

Applicants of superior quality will be among the students invited to the Eighth Annual Workshop for Advanced Undergraduates on Current Ideas in Nonlinear Science, March 5-8, 1994. Limited support is available for attendees. The workshop is designed to communicate topics in current active research in three areas: (i) Geometry and Physics, (ii) Geophysical Modeling, and (iii) Patterns.

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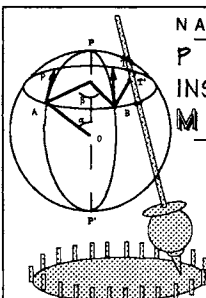
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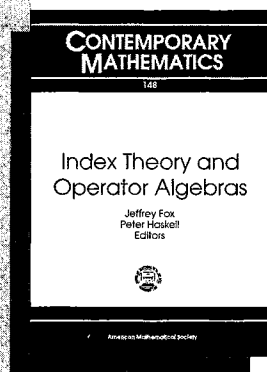
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Jeffrey Fox and Peter Haskell, Editors
Volume 148

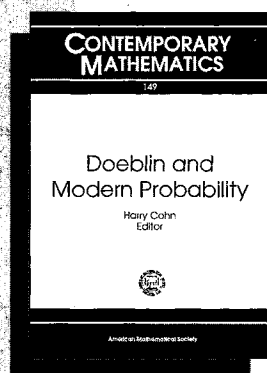
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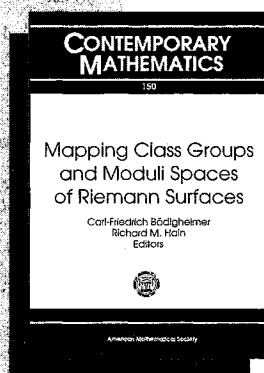
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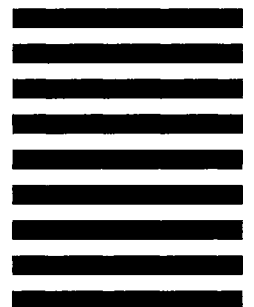
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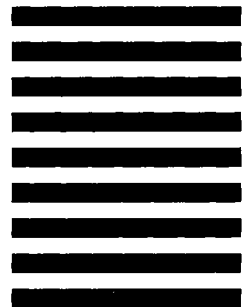
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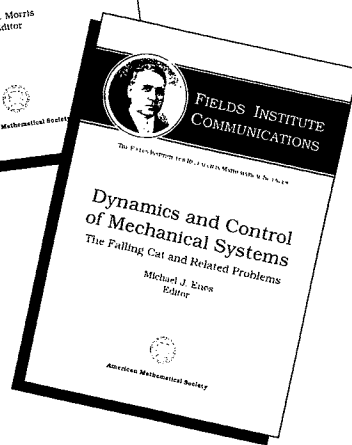
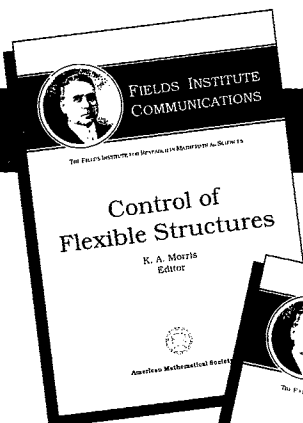
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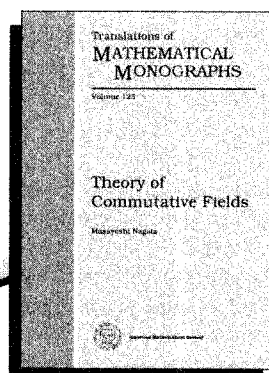
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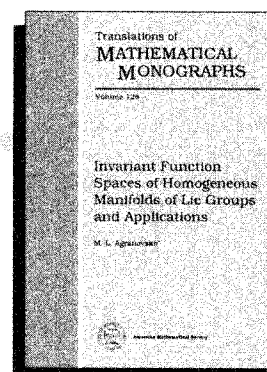
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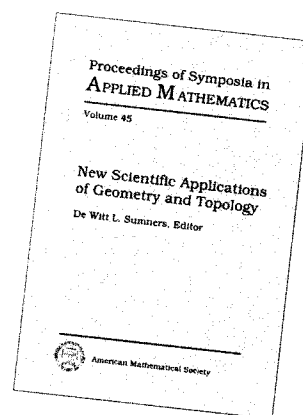
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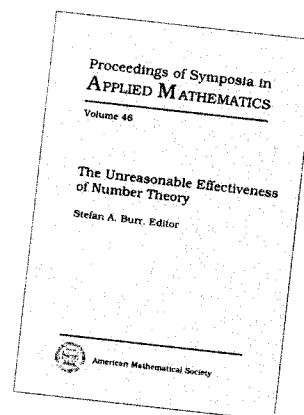


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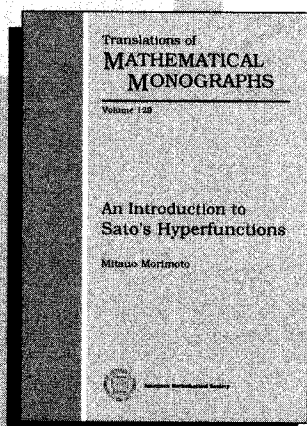
This book is based on the AMS Short Course, The Unreasonable Effectiveness of Number Theory, held in Orono, Maine, in August 1991. This short course provided some views into the great breadth of applications of number theory outside cryptology and highlighted the power and applicability of number theoretic ideas. This book will appeal to a general mathematical audience as well as to researchers in other areas of science and engineering who wish to learn how number theory is being applied outside of mathematics. All of the chapters are written by leading specialists in number theory and provide excellent introductions to various applications.

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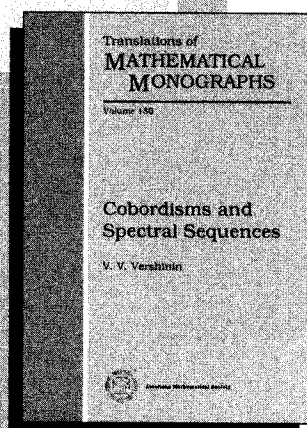
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