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Calendar of AMS Meetings and Conferences

This calendar lists all meetings and conferences approved prior to the date this issue went to press. The summer and annual meetings are joint meetings of the Mathematical Association of America and the American Mathematical Society. The meeting dates which fall rather far in the future are subject to change; this is particularly true of meetings to which no numbers have been assigned. *Programs* of the meetings will appear in the issues indicated below. *First* and *supplementary* announcements of the meetings will have appeared in earlier issues. **Abstracts of papers** presented at a meeting of the Society are published in the journal *Abstracts of papers presented to the American Mathematical Society* in the issue corresponding to that of the *Notices* which contains the program of the meeting, insofar as is possible. Abstracts should be submitted on special forms which are available in many departments of mathematics and from the headquarters office of the Society. Abstracts of papers to be presented at the meeting must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline given below for the meeting. The abstract deadlines listed below should be carefully reviewed since an abstract deadline may expire before publication of a first announcement. Note that the deadline for abstracts for consideration for presentation at special sessions is usually three weeks earlier than that specified below. For additional information, consult the meeting announcements and the list of special sessions.

Meetings

Meeting #		Date	Place	Abstract Deadline	Program Issue
872	*	March 13–14, 1992	Tuscaloosa, Alabama	Expired	March
873	*	March 20–21, 1992	Springfield, Missouri	Expired	March
874	*	April 11–12, 1992	Bethlehem, Pennsylvania	Expired	April
875	*	June 29–July 1, 1992 (Joint Meeting with the London Mathematical Society)	Cambridge, England	February 28	May-June
876	*	October 30–November 1, 1992	Dayton, Ohio	August 3	October
877	*	November 7–November 8, 1992	Los Angeles,California	August 3	October
878	*	January 13–16, 1993 (99th Annual Meeting)	San Antonio, Texas	October 8	December
879	*	March 26–27, 1993	Knoxville, Tennessee	January 5	March
880	*	April 9–10, 1993	Salt Lake City, Utah	January 29	April
881	*	April 17–18, 1993	Washington, D.C.	January 29	April
882	*	May 21–22, 1993	DeKalb, Illinois	February 26	May-June
883	*	August 15–19, 1993 (96th Summer Meeting) (Joint Meeting with the Canadian Mathematical Society)	Vancouver, British Columbia	May 18	July-August
		October 22-23, 1993	College Station, Texas		
		January 12–15, 1994 (100th Annual Meeting)	Cincinnati, Ohio		
		March 18–19, 1994	Lexington, Kentucky		
		March 25–26, 1994	Manhattan, Kansas		
		January 25–28, 1995 (101st Annual Meeting)	Denver, Colorado		
		March 24–25, 1995	Chicago, Illinois		
		January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		

* Please refer to page 233 for listing of Special Sessions.

Conferences

June 13–July 24, 1992: Joint Summer Research Conferences in the Mathematical Sciences, Mount Holyoke College, South Hadley, Massachusetts.

July 6–24, 1992: AMS Summer Research Institute on Quadratic forms and division algebras: Connections with algebraic K-theory and algebraic geometry, University of California, Santa Barbara.

July 26–August 1, 1992: AMS-SIAM Summer Seminar in Applied Mathematics, Exploiting symmetry in applied and numerical analysis, Colorado State University, Fort Collins, Colorado.

Deadlines

	May/June Issue	July/August Issue	September Issue	October Issue
Classified Ads*	May 5, 1992	June 16, 1992	July 30, 1992	August 27, 1992
News Items	April 20, 1992	June 8, 1992	July 16, 1992	August 13, 1992
Meeting Announcements**	April 23, 1992	June 11, 1992	July 20, 1992	August 17, 1992

* 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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NOTICES
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From the Executive Director . . .

IMPLEMENTING THE STRATEGIC PLAN

A strategic plan for an organization is a template for action that lays out goals and objectives. However, it is the implementation of these actions that makes the plan meaningful and eventually provides the basis to evaluate its success. This issue of the *Notices* (page 192) has an article, "AMS Planning Update: The Operational Plan," describing the AMS 1992 Operating Plan. Many of the actions specified in the Plan are well into implementation.

One major step is an AMS Washington Office, to open in summer 1992. Other actions have been taken that position the Society to advocate for mathematics within government circles. The February *Notices* contained a report on a pilot assessment of mathematics, undertaken by the Society at the request of the U.S. House Committee on Science, Space, and Technology, in an attempt to assist the staff of that Committee as they consider ways that might bring more rationalization into federal science funding. The leadership of the Society has been involved in several discussion groups in Washington regarding science policy, including briefings at the Office of Science and Technology Policy at the White House.

Employment is a critical issue within much of the scientific community. The Society has an active Task Force on Employment which is studying the situation in mathematics and is to make recommendations this spring. Other concerns center on the apparent imbalances in our profession regarding recognition and reward for the broad scope of faculty responsibilities. The AMS has joined MAA and SIAM in supporting a joint committee to study this issue and make recommendations.

Two major Society activities, publication and meetings, are undergoing thorough review. The publication program has been reorganized, incorporating both an acquisition and a marketing component, which has introduced new series and placed AMS publications in bookstores all around the world. A new committee will plan meetings activities for the Society, incorporating components on research, education, and applications of mathematics, as well as student and professional activities.

Among the strategies of the 1992 Plan are directives to various Society committees to develop long-range plans. The AMS Committee on Science Policy has been charged to develop a three- to five-year "science strategy" addressing issues facing the mathematical research community, including renewal; levels and quality of federal, academic, and corporate support; communication; and connections to mathematics education and the uses of mathematics. Four "working groups" of the Committee will draft plans to be incorporated into future actions of the Society.

Similarly, the AMS Committee on Education has received a charge to develop an "education strategy" from which the Society can effectively contribute to the encouragement of mathematically talented students, to education at all levels, and to the continuing professional development of mathematicians. This task has also been assigned to working groups of committee members and volunteers who will produce a detailed strategy by the end of this year.

A Committee of Council members, volunteers, and staff is studying the Society's committee structure. The work of the Society is done through a combination of volunteer and staff activities that are organized mostly through its committee structure. The goal is a plan for committee organization and management, which is efficient and effective in carrying out the work of the Society, and in developing a synergy between volunteers and staff.

The Long Range Planning Committee is responsible for overseeing the strategic direction of these planning activities, monitoring progress, and evaluating the effectiveness of carrying out the Society mission and achieving its goals. Members of the Board of Trustees, members of the Council, and other volunteers are all part of planning groups having the responsibility of monitoring progress toward 1992 strategies and putting together a detailed plan of action for 1993. All of these groups welcome comments and recommendations from members and others interested in the activities of the AMS.

William Jaco

Letters to the Editor

Mathematics as a Career

What are We Doing Wrong?

There has been a lot of discussion about the shortage of people willing to go into Mathematics as a career. I would like to add one further point, namely that the award structure discourages everyone—men, women, minorities.

In business, law, medicine, accounting, if you are competent, you can be a respected member of the profession. You don't have to be an appellate court judge, CEO, or managing partner in a huge firm to get respect. Not so in Mathematics. If you have not been a Sloan Fellow or are not destined to become an Academician, you are one of the great unwashed. This shows up in the way NSF now awards research support. Large grants to the very best people, little to the rest. (To say nothing of the cynicism generated by the fact that the class of mathematicians that established and continue the policy is the class that most immediately benefits.)

Some people love Mathematics so much that they will choose Mathematical careers in spite of the above, and others are arrogant enough to believe that they will be one of the very best (and a few of them are right). But a large number will say, "I will not work for 5–7 years for a Ph.D. to enter a relatively low paying profession providing a low probability of winning the respect of my peers."

Let's change our attitudes and policies. The U.S.A. should support research in Mathematics, not only because the research is, indeed, of value, but also because by supporting research, we make Mathematical careers attractive to more people.

Colin C. Graham
Lakehead University
(Received November 27, 1991)

Letters to the Editor

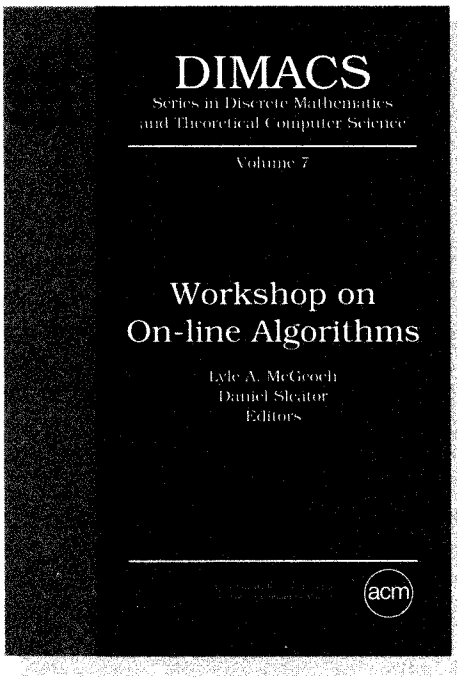
Letters submitted for publication in the *Notices* are reviewed by the Editorial Committee.

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 email to notices@math.ams.com, and will be acknowledged on receipt.



Workshop on On-line Algorithms

Lyle A. McGeoch and Daniel Sleator, *Editors*

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science

Volume 7

This volume contains the proceedings of the Workshop on On-line Algorithms held at the DIMACS Center at Rutgers University in February 1991. Presenting new results in the theory of on-line algorithms, the articles discuss a broad range of problems. Most of the papers are based on competitive (worst-case) analysis of on-line algorithms, but some papers consider alternative approaches to on-line analysis. Many of the papers examine the ways randomization can be used to yield algorithms with improved performance. This book is aimed primarily at specialists in algorithm analysis, but most of the articles present clear expositions of previous work, making reading easier for nonspecialists.

1991 *Mathematics Subject Classification*: 68,
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NSF's Regional Geometry Institutes

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) has funded three Regional Geometry Institutes (RGIs)—experimental summer programs designed to integrate research and education. In this time of tight budgets for mathematical sciences research, the DMS and the mathematical community are watching the RGIs closely. What follows are three articles about the RGIs. The first, written by one of the RGI organizers, presents some philosophical perspectives. The second reports on a meeting at which the RGI organizers discussed their experiences, problems, and successes. The third presents information about this summer's activities at all three RGIs.

The Park City Institute: A Mathematician's Apology*

Herb Clemens, University of Utah

The purpose of the Regional Geometry Institutes, begun as an experiment by the National Science Foundation a few years ago, is to integrate teaching and research in geometry, from its first introduction in school to advanced geometry research. We geometers like to think that our field was chosen for this experiment because it is the center of all of mathematics, if not of the entire universe. But I must confess that we are haunted by the nagging suspicion that we have simply been judged to be more in need of help than other mathematical disciplines!

In any case, five universities, in what can be called the west only from a perspective east of Baltimore, have one of these experiments going in Park City, Utah, for a month in the summer. We also have follow-up programs in our five cities, Austin, Houston, Chicago, Seattle, and Salt Lake City, during the school year. From the extensive feedback we have gotten from participating teachers and researchers, we think we are onto something good!

*Presented during the AMS Special Session on Mathematics and Education Reform at the Joint Mathematics Meetings in Baltimore on January 10, 1992.

But that is not what I want to address in these few minutes. It is rather the dilemma that an enterprise such as the RGI is posing to the mathematical community, a dilemma which cannot be overcome without a good deal more leadership, generosity, and tolerance than we have been able to bring to it so far.

It seems to me that we mathematicians are being put into a dangerous situation by the introduction of federally funded "mathematics and education" experiments like the RGI at this particular moment. Perhaps funding for these experiments is driven by the questionable belief that, just because mathematicians are good at mathematics, they should also be able to contribute to the effective presentation of elementary mathematics to an often unmotivated and unresponsive public. Maybe those who have struggled to learn mathematics and to make its alien rhythms intelligible, and have derived satisfaction and profit from doing so, are the candidates for good educators, rather than those whose innate gifts make the subject relatively easy and natural. In any case, there is no consensus in the mathematical community, or in the educational community, or in the funding agencies, as to the value of the experiments. So we are being urged to participate in something which many of our colleagues judge to be of dubious value, at a time when there are fewer resources available. To paraphrase an NSF program officer, the conventional wisdom is that money for educational experiments like the RGIs is not coming out of the same pot as money for summer research grants to individual researchers, but the conventional wisdom cannot be trusted. I accept that judgment at face value and would talk a bit about the dangers of fighting among ourselves over these contracting resources.

There is little doubt that the country in general and the United States Congress in particular are telling the research community that mathematical research is less important to them than mathematical education. From my personal point of view, there are two implied fallacies: first, that research and education can be separated, and second, that research mathematicians have it in their power to do something major to correct what is ailing the U.S. educational system. The general public, in pursuing these fallacies: and mathematicians, in resisting the second one, run the risk of damaging mathematics, without doing anything positive

for education. In short, every time we squabble over the relative merits of involvement of the research mathematics community and its scarce resources in reform of elementary and secondary education, we give additional justification to those who would contract those resources even more.

There is enough blame to go around for the existing situation, but, as usual, blame won't get us anywhere. What is clear is that, if research mathematics is going to avoid more damage and a further contraction of resources imposed from without, it is going to have to reach some consensus on a strategy for responding positively to public concerns while not, at the same time, betraying our subject and future generations of mathematicians. This will demand intelligent discussion in, and strong leadership from, our professional societies. It will demand that those educators pressing for more involvement by research mathematicians in educational problems show more respect for research mathematics pursued for its own sake and for the precious talent of those who do it well. It will demand that research mathematicians show more respect for the enormous difficulties of mathematics education in the setting of a mass non-elite audience, and more respect for the intelligence and precious talent of educators who manage to achieve success in that setting. And it will demand that mathematicians find ways to positively influence elementary and secondary mathematics education at the margins, both because it is good to do so and because, in these times, it is an absolute political necessity to do so.

The RGIs, then, are a modest effort to let mathematicians do mathematics and teachers do education in a mutually respectful and supportive environment. Each group can see and learn what the other does, talk, ask questions, make comments, and unburden itself of its acquired prejudices. The Institutes let mathematicians do something minor about education by doing what they do best, namely think about mathematics, provided only that they make a relatively painless attitude adjustment which allows a little more communication with other educators. It allows high school teachers the opportunity to do some mathematics that is close enough to their classrooms to matter.

The mathematics has to be "top-of-the-line"; if this experiment is going to become something of permanent value, research mathematicians will have to be attracted to it fundamentally by the mathematics. In the same way, teachers will also have to come because of enlightened self-interest. So they will have to have the opportunity to do good mathematics that infuses their future teaching. And everyone will have to listen to teachers on the nature and challenges of mathematical communication to mass audiences.

The delightful thing is that all this can be accomplished relatively painlessly, without materially distracting either group from what it does best. To me this is the fundamental lesson of the RGIs. We provide a context in which it is easier for very different groups, with different but mutually related interests, to listen to each other with some respect and patience. The Geometry Institutes can address real educational problems, for example the problem of graduate mathematics education, better in settings where education at all levels is an explicit concern. One of the educational successes of our Institute this last year was the Graduate Summer School, where truly introductory courses to a specific area of research, in this case geometry and quantum field theory, were offered with a quality and scope unavailable at any single graduate school. At the same time, the Geometry Institutes can offer teachers an opportunity to do some serious mathematics, and to get to know some serious mathematicians, in a manner which is directly applicable to their classrooms.

We in the mathematical community can debate the value of experiments like the Geometry Institutes till the cows come home, and nothing will be achieved except further erosion of the political capital of our profession. We can complain that these Institutes and other similar efforts are destroying research by robbing it of sorely needed resources. But this will do nothing to deflect the criticisms of an unsympathetic public. In a country such as ours, that public has the final control of the purse strings, and we need some measure of public support. A prudent course for us is to incorporate into our activities those involvements with primary and secondary education through which we can, because of talents we do have, make some real contribution. For the rest, we need to be vocal and outspoken in our support for other individuals and educational organizations.

I feel strongly that experiments like the Geometry Institutes are among the relatively few existing initiatives in which research and elementary education can make real mutual contributions, and I am confident that this assessment of their worth is shared by most RGI participants. In the long run, initiatives like the Geometry Institutes will generate respect and financial support for mathematical research which will far outweigh their cost.

The Geometry Institutes: How is the Experiment Working?

Allyn Jackson, Staff Writer

The DMS at the NSF is the custodian of about half of all federal dollars for support of mathematics research. Just how the DMS spends those scarce dollars has been a subject of debate in the community in recent years, as the Division has tried to expand its menu of support mechanisms to include activities other than traditional research grants.

In 1989, the DMS developed the RGIs, "vertically integrated" summer programs bringing together researchers, postdocs, graduate and undergraduate students, and school-teachers. The Institutes were originally motivated by the increasing importance of geometric ideas and methods in a variety of areas of mathematical research. The DMS also saw the Institutes as a means for addressing a number of different concerns within the community: "retooling" for mathematicians who wanted to learn about a new area or

who had been away from research for a while, continued training for postdocs and graduate students, and fostering connections between researchers and precollege teachers.

In the first year of the program, DMS made a three-year grant for an RGI in dynamical systems, directed by Robert Devaney of Boston University. The following year, two more RGIs were funded. One is in Park City, Utah, under the direction of C. Herbert Clemens of the University of Utah. The other, centered at the Five Colleges consortium (Mount Holyoke, Smith, Amherst, and Hampshire Colleges and the University of Massachusetts at Amherst), was directed in 1991 by Donal O'Shea of Mount Holyoke College and this year is headed by David Cox of the University of Massachusetts at Amherst. At a meeting last fall at the Geometry Center in Minneapolis, representatives from all three RGIs met to discuss their experiences and to ponder future plans.

There has been grumbling (some might describe it as shrieks) within the community about DMS spending its severely limited funds on programs like the RGIs. However, the funds used for these Institutes were given to DMS specifically for that purpose and could not simply be redirected into PI grants, and it's impossible to say whether or not the DMS would have received those funds without proposing the RGIs. Perceptions that the RGIs commit the DMS too heavily to educational activities are also debatable. For one thing, the funds for the educational components of the Institutes came from the Education and Human Resources (EHR) directorate of NSF; in the case of the Park City and Five Colleges Institutes, EHR picked up the tab for about half of each. DMS covered the entire budget of the Boston University Institute, since it was organized differently from the other two—its educational component consisted of interactions with two EHR-funded summer programs at Boston, one for high school teachers and one for high school students.

So perhaps the pertinent question is not whether activities such as the RGIs are draining DMS funds intended for research, but rather, are those funds being used in the best way? That's a difficult question to answer, even for the RGI organizers. At the Minneapolis meeting, they were keenly aware of negative perceptions about this kind of program and were serious in discussing the successes and shortcomings.

One of the clear successes was attracting top-quality mathematicians for the research part of the Institutes. The Park City RGI concentrated on geometry and quantum field theory, with Karen K. Uhlenbeck and Daniel S. Freed, both of the University of Texas at Austin, as the main organizers. The principal speakers were Frank Quinn, Jeff Rabin, Isadore M. Singer, Orlando Alvarez, and Robert Bryant. The Five Colleges focused on problems in the geometric calculus of variations, including minimal and constant mean curvature surfaces, with its research component headed by Robert Kusner of the University of Massachusetts at Amherst. There the principal speakers were: Frederick Almgren, Thomas Banchoff, Marcel Berger, Jean-Pierre Bourguignon, Dennis de Turck, Li-zhong Gao, Carolyn Gordon, Herman Gluck, David Hoffman, Hermann Karcher, Frank Morgan, Richard Palais, Franz Pedit, Jean E. Taylor, and Chuulian Terng. At Boston University, five specialists spoke on various aspects of dynamical systems: Bodil Branner, Jenny Harrison, Curt McMullen, John Milnor, and Christopher Zeeman.

The RGI organizers seemed to agree that the research components ran the most smoothly. In contrast to graduate students and high school teachers who seemed to be less accustomed to attending this kind of conference, the researchers knew what they wanted to get out of the Institutes and how to make the most of their time there. In the case of the Park City RGI, all thirty participants in the research component were at approximately the same level and were quite close in their interests. The approximately thirty researchers at the Five Colleges RGI comprised people who were active in research and others who had done their doctoral work in geometry but who were no longer active in research. Kusner reports that some of the latter group seemed "lost" and were observing more than participating. The RGI at Boston University was specifically designed for faculty from institutions with little expertise in dynamical systems. The four-week program featured a different topic and different principal speakers each week; attendance varied from ninety to 120 people.

Kusner noted that at the Five Colleges RGI, groups spontaneously organized themselves around various topics, and eventually the lectures gravitated toward a more interactive mode, with many questions from the audience. Some of the participants used humor to get their ideas across: one of them, Colin Adams, appeared as a real estate salesman, Mel Slugbait, who tries to sell plots of land in hyperbolic space. The situation for graduate students, postdocs, and undergraduates seemed to be more variable than for the researchers. In some cases, these groups had difficulty making contact with the researchers they were interested in meeting. There were opportunities to do so, but sometimes the appropriate social context was lacking—as one organizer put it, the younger people weren't always able to "grab" the person they wanted to talk to. In addition, Naomi Fisher, who directed the component for high school teachers at the Park City RGI, noted that the graduate students and postdocs were the most singlemindedly focused on research, making it particularly difficult to get them to connect with the high school teachers.

Although fostering interactions between the research and education ends was probably the most difficult part of the RGIs, it seems it was also the most rewarding aspect. For example, Kusner pointed out that several of the researchers at the Five Colleges RGI spent a good deal of time working extensively with the teachers. One of the Institute's major successes, he says, is the positive impact the environment had on some of the research mathematicians and their willingness to work informally with the teachers. Though rewarding, such interactions don't always come easily. At the Park City RGI, John Polking of Rice University presented a series of lectures for the teachers on a vector-based approach

to geometry. Fisher says that, in the first couple of days, he gave "lovely" lectures but "several of the teachers went into shock." Feedback from the teachers helped Polking to reshape the course to their needs and expectations.

Part of the reason for this difficulty, Fisher explains, is that, in most high school geometry classrooms, "the two-column proof is still God." The teachers saw geometry as a way to teach the students how to do proofs; constructions were viewed as technical feats to be done with a compass and straightedge, not as tools for understanding geometrical concepts. Fisher says the RGI helped to shift the teachers' thinking so that some began to realize that geometry poses intriguing problems requiring visualization, experimentation, and reasoning, and that a one-paragraph proof is as good as a two-column proof. Several of the teachers, she says, now report spending more class time on open-ended problems and are more comfortable with being eclectic in choosing what to do in the classroom.

The reactions of some of the teachers offered an interesting view on what the mathematics research community looks like from the outside. Marty Conway is a high school mathematics teacher in Massachusetts who organized the component for teachers at the Five Colleges RGI. He says the twenty-four teachers often had a hard time coming to terms with the lectures. They found it "enraging" that only five to ten minutes of the talks were comprehensible. Mathematicians commonly find themselves in this position during mathematics talks, but they usually don't worry about it. Conway says that some of the teachers, feeling they *must* "get it," reached a sort of "white knuckle energy level" and ended up feeling that mathematics has formed a "hostile" community that's difficult for outsiders to penetrate.

In a precis of entries from the teachers' journals at the Five Colleges RGI, one of the teachers summed up this feeling: "We [teachers] certainly have more highly developed communication skills than do many of the researchers who have lectured here. What good is knowing something if you cannot communicate it to someone else in an understandable yet non-condescending way? We teachers at least make an effort to become exceedingly well acquainted with certain ability levels of our audience and tailor our presentations accordingly. We also make every possible effort to become very well acquainted with the audio-visual equipment that we use and do not waste time trying to get a piece of equipment to work during the presentation. I find this a display of inefficiency and disregard for one's audience. In other words, get your act together before taking it on the road!!!!"

Despite this kind of strong reaction, it seems that, for the most part, the RGIs can provide a mutually respectful setting in which different groups can learn and exchange ideas. There's been a great deal of talk in the community in recent years about bringing research and education closer together, and the RGIs seem to be an honest effort to move from talk into action.

Summer 1992 at the Regional Geometry Institutes

The following text was prepared by some of the organizers of the 1991 Regional Geometry Institutes (RGIs): Herbert Clemens, Marty Conway, Robert Devaney, Naomi Fisher, Robert Kusner, and Donal O'Shea.

The National Science Foundation has funded three RGIs: one at Boston University, one at Five Colleges, and one in Park City, Utah. The RGIs are an experiment: an attempt to blend cutting edge mathematical research conferences with educational activities that are traditionally not part of the pure research enterprise. The goal is to establish links between different parts of the mathematics profession with a view to supplying enough mathematically trained individuals to sustain the profession and meet our nation's needs in the foreseeable future. The three Institutes address these goals differently.

The Boston Institute

The Boston project, which has been running for two summers now, brings together teachers from high schools and colleges, graduate students, and researchers for a series of four week-long conferences on dynamical systems theory. This summer's program includes the following conferences: 1) Strange Attractors and Knots (P. Holmes and R. F. Williams, July 6-10); 2) Dynamics of Annulus Maps (G. R. Hall and J. Franks, July 12-16); 3) Complexity and Computability over the Reals (L. Blum, M. Shub, and S. Smale, July 19-23); 4) Dynamics, Competition, and Neural Networks (M. Hirsch, July 26-30).

Two programs run concurrently with the Institute. One is a teacher enhancement project for high school teachers from the Boston area who wish to learn more about dynamical systems theory and the use of technology in the classroom. The second, called Program in Mathematics for Young Students (PROMYS), is for talented high school students. Participants in all three programs meet for joint lectures by distinguished mathematicians, share computer facilities, and speak in special sessions designed to foster communication among the various groups. Information about the research program and the teacher enhancement program is available by writing to: Dynamics Institute, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215; electronic mail: dynamics-inst@math.bu.edu. For information on PROMYS, write to: PROMYS, Department of Mathematics, Boston University, 111 Cummington Street, Boston, MA 02215.

The Five Colleges Institute

The Five Colleges project (sponsored by Amherst, Hampshire, Holy Cross, Mount Holyoke, Smith, and Williams Colleges, and the University of Massachusetts at Amherst) began last summer and will run again this summer and next. Last year, the Institute was hosted by Mount Holyoke and concentrated on Optimization in Geometry (minimal surfaces and soap bubbles, isoparametric foliations, calibrations, spectral geometry).

Hosted this year by Amherst College, the Institute will run July 5-31 and will concentrate on Computational Algebraic Geometry. The Institute begins with a two-week program intended to introduce algebraic geometers to the most important of the recently discovered algorithms for manipulating systems of algebraic equations and to their computer implementations. This program will feature many hands-on demonstrations and expository talks. Three more specialized programs devoted to Varieties of Low Dimension and Codimension, Combinatorial Methods in Algebraic Geometry, and Applications and Computational Issues are planned. So far, the following speakers have agreed to come: Alan Adolphson (Oklahoma State), John Canny (Berkeley), Wolfram Decker (Saarbruecken), Marc Giusti (Ecole Polytechnique), Joe Harris (Harvard), Sheldon Katz (Oklahoma State), Ian Morrison (Fordham), Richard Stanley (MIT), Stein Arild Stromme (Utah/Bergen), Christian Peskine (Paris VI), Bernd Sturmfels (Cornell), Hiroaki Terao (Wisconsin), and Andrei Zelevinski (Northeastern). In addition to speakers, there will be about forty algebraic geometers and twenty graduate students participating.

The component for high school teachers will run concurrently with the research part and will involve twenty-six high school teachers drawn from across the nation. The focus will be on exploring classroom and intellectual issues involved in integrating algebra and geometry and implementing the National Council of Teachers of Mathematics Standards at the high school level.

The undergraduate program, running June 8-July 31, will consist of two groups of four to five undergraduates, one working on computation of Betti numbers of semi-algebraic sets, the other on algorithms in power series rings. Substantial interaction with research groups of undergraduates at Mount Holyoke and Williams is also planned. The deadline for application is **March 15, 1992**. For application forms and more information, contact David Cox, Research Director, Regional Geometry Institute, Department of Mathematics and Computer Science, Amherst College, Amherst, MA 01002; telephone: 413-542-2082; electronic mail: rgi@cs.amherst.edu.

The Park City Institute

The Park City Institute project is sponsored by the University of Illinois at Chicago, Rice University, the University of Texas at Austin, and the Universities of Utah and Washington and will take place in Park City, Utah from June 21 to July 11, 1992. The Institute has four programs running concurrently: the Program for High School Geometry Teachers, the Undergraduate Program, the Graduate Summer School, and the Research Program. An important goal is the interaction among the groups on a regular basis.

A specific research topic is chosen each year for the Graduate Summer School and Research Program, which together comprise about fifty-five participants. Last year's topic was Geometry and Quantum Field Theory, and this year it will be Nonlinear Partial Differential Equations in Differential Geometry. The Graduate Summer School is aimed at advanced graduate students, postdocs, and researchers in other fields who wish to learn more about the research topic. There will be five guest lecturers over the three-week Institute: Luis Caffarelli (Institute for Advanced Study), Alice Chang (UCLA), Richard Schoen (Stanford), Leon Simon (Stanford), and Michael Struwe (ETH Zurich).

The component for high school teachers is part of a two-year program, with a core of thirty-seven teachers from the sites of the organizing universities. In this second year, the teachers will develop materials based on their classroom experiences in the school year, as well as continue their study of geometry and consider changes in teaching geometry in high school. The teachers' program includes a Computers in Geometry Lab, an Advanced Classical Geometry course, and other sessions in teaching methods. In addition, guest researchers from the Graduate Summer School and the Research Program will visit the teachers' sessions to discuss their work or a current topic in geometry research.

The Undergraduate Program will be aimed at approximately sixteen undergraduate students on two levels: those no further than multivariable calculus, and those that are very advanced, including graduating seniors. The first group will attend a class in Hyperbolic Differential Geometry, a Mathematics Lab, and Advanced Classical Geometry (with the high school teachers). The second group of undergraduates will attend the same Mathematics Lab, a writing group for a differential geometry "problem book," and one of the introductory lecture series in the Graduate Summer School.

For further information, contact: Summer Geometry Institute, Mathematics Department, 210 JWB, University of Utah, Salt Lake City, Utah 84112; telephone: 801-585-3488; fax: 801-581-4148; electronic mail: RGI@math.utah.edu.

Computers and Mathematics

Edited by Keith Devlin

This month's column

Three software reviews make up this month's column. *MATMAN*, *MATALG*, and *RK*124 comprise a courseware package designed to accompany a mathematics textbook, an increasing trend these days. This package is reviewed by William Ruckle. Then Edward Bender and Howard Rumsey, Jr. report their findings with *Perl*, and Jeffrey Augenbaum looks at *FOR_C*. Given the attention paid these days to computer graphics and visualization, powerful computer algebra systems, and fancy interfaces, these reviews remind us that there is still a lot of plain old "computational" software being used, and presumably therefore being found *useful*, where by "computational" I mean the old (i.e. pre-1975) sense of the word.

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Reviews of Mathematical Software

MATMAN, *MATALG*, and *RK*124

Reviewed by William H. Ruckle*

Courseware Developed by
John Burkardt and Charles G. Cullen

The proliferation of small computers has finally allowed us to introduce meaningful calculations into more mathematics courses. This opportunity leads to the following three hard problems:

1. How much instruction in programming the devices should be introduced into the course?
2. How much should we expand the computational portion of the course?
3. Which topics of the course should be dropped to make way for instruction in programming and expanded computations?

The courseware of Burkardt and Cullen provides a modest, yet rational approach to these problems for an undergraduate course in matrix theory and differential equations. The courseware is included with the Instructor's Manual to the second edition of the textbook by Charles G. Cullen entitled *Linear Algebra and Differential Equations – An Integrated Approach*, PWS-Kent, 1991, and is licensed only for users of the textbook.

The courseware consists of three interactive programs. *RK*124 finds the numerical solution of a system of up to four first-order differential equations using Euler's method or Runge-Kutta methods of order 2 or 4. The program will also graph solutions and the flow field. *MATALG* performs matrix and scalar calculations. *MATMAN* performs row reduction matrix operations either in floating point or rational arithmetic.

The programs included with the Instructor's Manual run on PC compatibles. They ran successfully on an IBM PS-2 model 70, a generic '386 clone and a NEC Multispeed portable. The graphics on *RK*124 require CGA graphics capability. The authors offer a MacIntosh version of the software for a five dollar fee.

The three programs require almost no prior instruction. The sample transcripts found in the Instructor's Manual provide an adequate beginning. Generally, the user enters single letter commands, and the program prompts for data. On the other hand, there is no intrinsic value in learning how to use these programs.

A useful feature of all three programs is the capability to record a transcript of the session, which the instructor can examine. The appendix contains two sample transcripts that accurately depict the programs' screen output. Devotees of the Nintendo interface (pull down menus, dialogue boxes) may be disappointed by the straightforward operations of these programs.

At Clemson we have tried since the '70s to introduce a computational dimension into the introductory course in differential equations (DE), more recently into the course

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in elementary linear algebra. The present system for the DE course has two tracks. One group buys Hewlett Packard 48SX calculators and attends "calculator enhanced" sections. These students key in programs which do essentially the same things as *RK*124. The second group is supposed to do four lessons using *Mathematica*, available in a computer laboratory. Both of these schemes make the student expend more time and effort in interaction with devices than does the courseware under review. On the other hand, there may be some value in learning to use these devices. My own inclination is for courseware like that of Burkardt and Cullen because 1) it is less disruptive to instruction and 2) the student has less reason to claim credit for knowledge and skill (mostly button pushing) which is not part of the true goal of the course.

Cullen's text does not need the courseware under review to be the basis for a good course. The instructor can use other software or none at all. However, the courseware enhances the text, and in the future we expect to see a trend for such software to accompany textbooks.

Appendix

Here are two transcripts—one from *RK*124 and one from *MATALG*. A transcript from *MATMAN* resembles one from *MATALG*. I have edited the transcripts and placed comments within triple slashes so /// comment ///.

RK124

```
RK124 is opening the file Aug14
Enter command (H for help) /// A cursor would be nice. ///
b /// Sets up problem. See example 1 on p. 293 of Cullen. ///
NEQN is the number of equations, between 1 and 4.
Enter NEQN
3
TINIT is the initial value of the independent variable.
Enter TINIT
0
Y1 is the initial value of the first ODE component.
Enter Y1
1
The initial value of Y2 is needed.
Enter Y2
0
The initial value of Y3 is needed.
Enter Y3
0
We need to enter the right-hand sides of the form
Y1'=F(T,Y1) (or perhaps a more complicated form).
Enter Y1'
Y1+Y3
We need the formula for Y2'
Enter Y2'
Y2+2*Y3
We need the formula for Y3'
Enter Y3'
Y1+2*Y2+5*Y3
If a formula for Y1 is known, enter it now, or a blank.
Enter X1 /// Can be graphed on the same axis with solution. ///

This variable will now be undefined.
We can accept the formula for Y2 now, or a blank.
Enter X2

This variable will now be undefined.
We can accept the formula for Y3 now, or a blank.
Enter X3

This variable will now be undefined.
The number of the ODE method is needed. (1-3)
0=Help, 1=Euler, 2=RK2, 3=RK4
Enter METHOD
1
Method=Euler method
Please specify the number of steps to take (1-200)
Enter NSTEPS
100
Please specify the value of T at which to stop.
Enter TSTOP
2
Problem has been set up
Use the C command to integrate.
Enter command (H for help)
C

Step     T       Y1       Y2       Y3
  0   .00000000   1.0000000   .00000000   .00000000
                  /// omit 19 lines of numbers ///
100   2.0000000   2790.0370   5565.5850   13920.210
Enter command (H for help)
/// The remainder will be omitted. ///
D ///Command to close transcript. ///
RK124 is closing the disk transcript file.
```

```
MATALG is opening AUG14A

Enter command (H for menu or ? for full help)
=A /// I had previously entered this 5 X 5 matrix.///
FORMULA=

Columns      1 to 5
       1        1        1        1        1
   .600000 .360000 .216000 .129600 .777600E-01
   .500000 .250000 .125000 .625000E-01 .312500E-01
   .300000 .900000E-01 .270000E-01.810000E-02 .243000E-02
   .200000 .400000E-01 .800000E-02.160000E-02 .320000E-03
Enter command (H for menu or ? for full help)
=DET(A) /// find determinant ///
FORMULA= .145151E-06
Enter command (H for menu or ? for full help)
B=INV(A) /// find inverse ///
FORMULA=

Columns      1 to 5
   .160708 -10.4165 23.9998 -47.6190 46.8750
   -1.92852 118.055 -263.999 460.318 -375.001
   8.12487 -454.859 973.332 -1444.45 1057.30
   -14.2856 694.443 -1400.00 1825.41 -1250.01
   8.92852 -347.222 666.668 -793.657 520.839

Enter command (H for menu or ? for full help)
P A /// Calculate characteristic polynomial. ///
X**5-1.49342*X**4-1.12821*X**3+.963200E-01*X**2+
.499055E-03*X-.919192E-07
Enter variable to save polynomial in, or RETURN.
D
MATALG is closing AUG14A
```

Consider *Perl*

Reviewed by Edward A. Bender and Howard Rumsey, Jr.

Introduction

Since *perl* was developed as a file manipulation and data reduction language for UNIX, it is natural that many mathematical programmers will not have heard of it. We had barely heard of it and had never used it until we were faced with writing a program to count hamiltonian paths and cycles in the $n \times n$ lattice. Our method involved transition matrices that were most naturally indexed by character strings describing the states. Although the algorithm has a symbolic flavor, it does not fit into the more mathematically oriented symbolic mode of languages such as Maple and Mathematica. What we wanted was string processing and associative memory. While this could have been implemented in a language like C, it would have involved considerable work.

Somewhat dubiously, we decided to try *perl*. Once we knew enough about the language, we were able to implement the algorithm quickly. The resulting code is brief and, we believe, quite readable by someone familiar with *perl*. It ran without change under both UNIX and MS-DOS. Unfortunately, the 640K limit under DOS tends to cramp *perl*. The complete code is included at the end of this review. If you have some familiarity with C, the following discussion should enable you to understand most of it.

Some Perl Basics

In many ways *perl* resembles C. Some of the more apparent differences are the following:

- *Perl* runs interpretively. This may preclude using it in situations where running time is a major issue; however, it may still be useful for testing ideas in such situations.
- Code starts right at the beginning, with no C style "main" program.
- Variables are not declared.
- String processing features are present. As usual with UNIX, one can use regular expressions, which we'll say more about later.
- Arrays can have rather arbitrary indices—these are the associative arrays.
- Identifiers are preceded by strange symbols, namely

  $ indicates a scalar,
  @ indicates a standard array,
  % indicates an associative array,
  & indicates a subroutine (function).

Scalars include integers, floating point and strings. The variable _ (underscore) plays a special role—it can fill in for a missing argument. (This sounds confusing, but if it is used judiciously, it can make code more readable.)

A regular expression is a string delimited by /. Certain characters in the string have a special meaning. The only ones we shall need are:

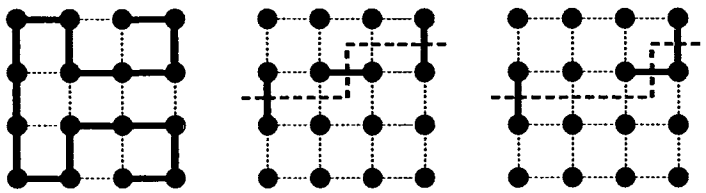
- a period matches an arbitrary character,
- an asterisk repeats the previous string symbol arbitrarily (perhaps zero times),
- a dollar sign on the right matches the end of a string.

For example, `/1.*1$/` matches any string that ends with a one and contains at least one other one while `/1. .*1$/` matches any string that ends with a one and contains another one not adjacent to it.

Our Algorithm

The left-hand figure shows a typical hamiltonian path on a 4×4 lattice. In an $n \times n$ lattice, we introduce a cut through graph edges. The cut starts a half unit to the left of the lattice and ends a half unit to the right. It consists of two (possibly empty) horizontal segments and a jog (a one unit long vertical segment). We only consider the nature of the edges that cross the cut. A "state" is described by the cut together with an $n+1$ long string over $\{0, 1, \mathrm{L}, \mathrm{R}\}$, where the kth string element describes the state of the kth edge crossed by the cut. The symbols in the string have the following meanings:

0 indicates an edge that is not part of a hamiltonian path,
1 indicates an edge that is part of a path which, when followed above the cut, leads to an end,
L[R] indicates an edge which, when followed above the cut, leads back to the cut to the right [left] of the starting position. That end will be labeled R[L].



A hamiltonian path can be thought of as a sequence of states, each cut having one more vertex above it than the previous cut—the sequence starts with no vertices above the cut and ends when all vertices are above the cut. (In the center figure, the cut and the string L0R01 describe a state associated with the hamiltonian path in the left-hand figure.) The states that can immediately follow a given state S and lead to a hamiltonian path depend only on S and not on the states preceding S. This leads naturally to a recursive counting procedure in which we associate with each state the number of "partial" hamiltonian paths that contain it. We will not define a partial hamiltonian path—you can think of it as something that apparently could be completed to a

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hamiltonian path given that there is enough lattice below the cut. The requirement that there be enough space is to avoid having to look ahead at boundary conditions to realize that certain states are impossible. We simply avoid this look-ahead and throw out impossible cases at a later time.

A single step of our algorithm consists of moving the cut so as to include one more vertex above the line. At each step, we keep track of the number of partial hamiltonian paths that could reach each state. There are two possible states that can follow the one in the center figure: L00R1 and L0R01. The former is illustrated. It can only be followed by 10000. On the other hand, the state L0R01 can be followed by L0R10 and L0R01. In the step after that—moving from the right side to the left—we will accept L0R10 but discard L0R01 because it has an edge that runs out the right side of the lattice. (L0R01 is an example of an impossible case that arose because of no look-ahead and was then thrown out.)

In order to determine the states that can follow a given state, we look at two letters in the state—the one corresponding to the lattice edge crossing the jog in the cut and the one corresponding to the lattice edge crossing the cut just after the jog. In the middle and right-hand figures these are R0 and R1, respectively. In our program, given at the end of the article, we put the two characters in $_ and then take action depending on what the two characters are. Of course, some possibilities are illegal; for example, we cannot join two 1s except at the end and we cannot create a new 1 if two of them already exist. These possibilities are spelled out in the subroutine `onestep`.

The subroutine `bal` finds the other end of a path connecting an L to an R. This can be done because the pairing of Ls and Rs is uniquely determined by the fact that they come from a partial hamiltonian path: since a path cannot cross itself, paired Ls and Rs must behave like nested balanced parentheses pairs.

The hamiltonian paths can have mirror or central symmetry. It does not take very many additional lines of code to count these, but the algorithm is a bit tricky and doesn't add to the purpose of this article. Here are some results.

```
Total paths  for N=4 is 276;
     28 with mirror symmetry.
Total cycles for N=4 is 6.
Total paths  for N=5 is 4324;
     68 with central symmetry.
Total paths  for N=6 is 229348;
     476 with mirror symmetry.
Total cycles for N=6 is 1072.
Total paths  for N=7 is 13535280;
     4056 with central symmetry.
```

Sources

Perl is available by anonymous ftp from a number of sites including

jpl-devvax.jpl.nasa.gov (UNIX) and
wuarchive.wustl.edu (DOS).

More details are given in *Programming perl* by Larry Wall and Randal L. Schwartz. If you are going to use *perl*, you'll want the book. It is published by O'Reilly & Associates, Inc., 632 Petaluma Ave., Sebastopol, CA 95472 (1991). If it is not available locally, you can order directly via 1-800-338-6887, UUCP: uunet!ora!nuts, or Internet: nutsora.com. There is also a newsgroup: comp.lang.perl.

Perl Code

```
for $N (4..7)              # The main program.
  { &do_hamilton_path_and_curve_count; }

sub do_hamilton_path_and_curve_count {
  $zN="0" x $N;
  %NS=("0".$zN,1); # Start with N+1 0's
    and a count of 1.
  for $R (1..$N) {     # Choose a row and ...
    for $k (0..($N-1)) # move the vertical
    cut along it.
        { &one_step; }
    &fix_state_list;   # Move to the next row.
   }
  print "Total paths  for N=$N is ",
      $NS{$zN."1"}+$NS{$zN."p"},".\n";
   print "Total cycles for N=$N is ",
      $NS{$zN."c"},".\n" if 0==$N%2;
}
sub one_step { # Step based on horizontal
and next vertical cut.
   %OS=%NS;   # Make new counts the old
     counts.
    undef %NS; # Clear out the new counts.
    # Run through each state $a (a string)
        and use its count, $ns.
    while (($a,$ns)=each(%OS)) {
     $_=substr($a,$k,2); # Extract the 2
        characters near jog
     if (/00/)             { &do1("LR");
        if ($a !~ /1.*1/) { &do1("10");
            &do1("01"); }
     }
     elsif (/01/ || /10/) { &do1("10");
            &do1("01"); }
     elsif (/0L/ || /L0/) { &do1("L0");
            &do1("0L");
        if ($a !~ /1.*1/) {&joinL("1"); }
     }
   elsif (/0R/ || /R0/) { &do1("R0");
            &do1("0R");
      if ($a !~ /1.*1/) {&joinR("1"); }
     }
     elsif (/1L/ || /L1/) { &joinL("1"); }
     elsif (/1R/ || /R1/) { &joinR("1"); }
     elsif (/LL/)         { &joinL("L"); }
     elsif (/RR/)         { &joinR("R"); }
     elsif (/RL/)         { &do1("00"); }
```

```
    # The very end is special ("p"=path,
       "c"=cycle).
    elsif (/11/) { &do1("p0") if
       ($R==$N && $k==$N-1); }
    elsif (/LR/) { &do1("c0") if
       ($R==$N && $k==$N-1); }
    else         { }
   }
}
sub fix_state_list { # If no edge off end,
   #    accept and step to next row.
   local(%L)=%NS; local($fs,$fn);
   undef %NS;
   while (($fs,$fn)=each(%L)) {
      if ($fs =~ /0$/) {
         $NS{"0".substr($fs,0,$N)}=$fn;
      }
   }
}
```

```
# Note: By default, the arguments of a
   sub are the array _.
sub do1 { # Create stepped state by changing
   the two characters.
   substr($a,$k,2)=$_[0]; # Insert the change
   $NS{$a}+=$ns;   # Increment the count
}
sub joinR { # Join a right cut and the
  path given by _.
   substr($a,$k,2)="R0";  # mark as R for &bal
   substr($a,&bal($k),1)=$_[0];
   &do1("00");
}
sub joinL { # Join a left cut and the
  path given by _.
   substr($a,$k,2)="L0";  # mark as L for &bal
   substr($a,&bal($k),1)=$_[0];
   &do1("00");
}
sub bal { # Find other cut end of path.
   local($pk)=@_;
   local($deltap,$p);
   $p=$deltapk=(substr($a,$pk,1)
      =~ /L/) ? 1 : -1;
   while ($p) {
      $pk+=$deltapk;
      $_=substr($a,$pk,1);
      ++$p if /L/;
      --$p if /R/;
   }
   return $pk;
}
```

FOR_C : a FORTRAN to C Translator

Reviewed by Jeffrey M. Augenbaum*

Although FORTRAN has long been the workhorse for scientific and mathematical programming, the C language [4], invented by Brian Kernighan and Dennis Ritchie at AT&T Bell Labs is becoming increasingly popular as the scientific programming language of choice for many mathematicians and scientists. *FOR_C* by Cobalt Blue, 2940 Union Avenue, Suite C, San Jose, CA 95124 is a FORTRAN to C translator designed to port existing FORTRAN code into clear, readable ANSI C code, which can then be compiled on any ANSI C compiler. This review covers *FOR_C* version 3.2 for MSDOS. *FOR_C* is also available on various Unix platforms including SUN OS, Unix/386, IBM RS6000 running AIX, and VAX VMS. The pc version requires an IBM compatible PC with MSDOS version 2.1 or later, 640k RAM, and one 360k floppy drive, although a hard disk is recommended. For this review, I used a 33MHZ 386 Gateway 2000 PC/AT.

Automatic conversion of FORTRAN to C is desirable for several reasons. "Some things such as storage management, some character operations, arrays of functions, heterogeneous data structures, and operating system calls are either impossible or simply much harder to express in FORTRAN than in C" [2]. Moreover, there is a very large body of robust and well tested FORTRAN code available for many tasks. Much of it, such as LINPACK and EISPACK, is available in the public domain from places such as Netlib [1].

Unlike other software, designed for constant reuse, *FOR_C* is designed to be used for one-time translations "and assumes that most people will maintain their program in C, because of its more powerful capabilities" [3].

FOR_C tries to be as faithful as possible to the original FORTRAN code in its translation, so as to produce C code that is easily readable and maintainable. Since there does not exist a one-to-one mapping of the syntax from FORTRAN to C, some FORTRAN constructs are emulated with the aid of a run time library which must be linked together with the translated C code when it is compiled. For example, FORTRAN I/O statements (a weak feature in FORTRAN) are supported (and do work); however, their translations do not represent the best possible C I/O. It is recommended that once translated, the I/O statements be replaced with more efficient C I/O functions. Other FORTRAN statements that give difficulties to the translator include ENTRY statements, COMMON BLOCKS, DATA statements, EQUIVALENCE statements (math function libraries), and ARRAY subscripts. All these statements will translate into C code which, with the aid of the run time library, will compile and run correctly. The resulting C code, however, may get to look quite messy and hard to follow.

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At this point, I should compare *FOR_C* with the public domain translator *f2c* developed at Bell Labs and available, for Unix platforms, through Netlib [1,2]. Both translators will produce C code which, when compiled, gives output consistent with the original FORTRAN source. However, *FOR_C* does a better job at producing more readable and easier to follow C code. This is illustrated by considering multidimensional arrays with variable dimension, a feature supported in FORTRAN but not directly in ANSI C [4,5]. The following FORTRAN subroutine computes the product of a matrix A and vector x and puts the result in b, i.e., $b = A * x$.

```
      subroutine mxv(b, a, m, x, n)
      implicit double precision(a-h,o-z)
      dimension b(m), a(m,n), x(n)
c
c Matrix Vector multiplication.
c i.e. b(m) = a(m,n)*x(n)
c
       do 20 i = 1, m
         b(i) = 0.0d0
         do 40 j = 1, n
            b(i) = b(i) + a(i,j) * x(j)
 40      continue
 20    continue
c
       return
       end
```

The resulting C Code as translated by *FOR_C* is

```
#include <fcrt.h>
 .
 .
 .
void /*FUNCTION*/ mxv(b, a, m, x, n)
double b[], *a;
long int m;
double x[];
long int n;
{
#define A(I_,J_)    (*(a+(I_)*(m)+(J_)))
long int i, i_, j, j_;

   for( i = 1L; i <= m; i++ ){
        i_ = i - 1;
        b[i_] = 0.0e0;
        for( j = 1L; j <= n; j++ ){
            j_ = j - 1;
            b[i_] += A(j_,i_)*x[j_];
                                    }
                                  }

return;
#undef A
} /* end of function */
```

whereas the resulting C code as translated by *f2c* is

```
#include "f2c.h"
 .
 .
 .
/* Subroutine */ int mxv_(b, a, m, x, n)
doublereal *b, *a;
integer *m;
doublereal *x;
integer *n;
{
    /* System generated locals */
    integer a_dim1, a_offset, i_1, i_2;

    /* Local variables */
    static integer i, j;

    /* Parameter adjustments */
    --x;
    a_dim1 = *m;
    a_offset = a_dim1 + 1;
    a -= a_offset;
    --b;

   /* Function Body */
   i_1 = *m;
   for (i = 1; i <= i_1; ++i) {
       b[i] = 0.;
       i_2 = *n;
       for (j = 1; j <= i_2; ++j) {
           b[i] += a[i + j*a_dim1] * x[j];
/* L40: */
     }
/* L20: */
    }

    return 0;
} /* mxv_ */
```

Both C translations account for the differing array index offsets. FORTRAN array indices start at one by default while C array indices start at zero by default. With regard to the treatment of the matrix $a(i,j)$, both C translations are correct. They both treat the multidimensional array a as a one-dimensional array. The *FOR_C* code, however, is easier to read and follow since it uses a local macro definition to achieve a multidimensional syntax similar to the FORTRAN source. The *FOR_C* code automatically transposes the indices i and j in the matrix A to account for the row-oriented storage scheme used in C as opposed to the column-oriented storage scheme used in FORTRAN. This does not produce a correct translate when certain FORTRAN programming "tricks" are used, such as using both linear and multi-dimensioned addressing to access the same array. In the following FORTRAN example subroutine, *FOR_C* returns the (i,j)th element of the matrix A by calculating

explicitly the linear address of $aij = A(i,j)$ based on the column-oriented storage of A.

```
      dimension A(m,n)
c initialize A
      do 20 i=1,m
          do 20 j=1,n
             A(i,j) =
 20   continue
      i =
      j =
c get the (i,j)th element of A
      call foo(aij,A,m,n,i,j)
      stop
      end

      subroutine foo(aij,A,m,n,i,j)
 c return the (i,j)-th element of A
      dimension A(m*n)

      aij = A(i+(j-1)*m)
      return
      end
```

However, when this code is translated into C, the rows and columns of A are reversed and the explicit formula for $A(i,j)$ is no longer valid. The program has no way of knowing what the programmer had in mind and an incorrect translation results. The moral here is that *FOR_C* , as any translator, is not foolproof, and the user should be familiar with the differences and similarities between FORTRAN and C to know when hand modification is necessary.

Using *FOR_C* is quite simple; like using a compiler, which it almost is. You simply type *forc fn (options).* Amongst the options that one can specify is that the FORTRAN source is written in either FORTRAN 66, FORTRAN 77, SUN FORTRAN, or VAX FORTRAN. The output options include K & R style C, ANSI C, and prototype generation. I had no problems translating several FORTRAN source decks of about 1000–2000 lines and compiling the resulting C code with the built-in ANSI C compiler included in both of the BORLAND and ZORTECH C++ compilers. None of the examples I tried required any hand modification to compile and run correctly. Documentation is contained in one looseleaf bound user's manual. The manual is comprehensive and well laid out and includes a tutorial section.

Since FORTRAN is not a structured language, as C is, it is easy to produce FORTRAN code that is difficult to follow. Poorly written FORTRAN code will translate into poor C code. This is especially true if GOTO statements are used extensively. Cobalt Blue also produces software tools *PRO_STRUCT* and *FOR_STRUCT* which are designed to transform spaghetti FORTRAN-IV and FORTRAN 77 code into fully structured code. *PRO_STRUCT* converts IF-GOTO and GOTO statements into equivalent IF-THEN-ELSE and DO-WHILE constructs. It also transforms DO...CONTINUE into DO...ENDDO, and eliminates most labels. The result is structured FORTRAN code. *PRO_STRUCT* will transform FORTRAN source code of any size provided each subroutine is less than 500 lines. *FOR_STRUCT* is a superset of *PRO_STRUCT* . It can transform subroutines up to 1500 lines and includes an option to structure to FORTRAN 77 with FORTRAN 90 extensions. To produce the most readable C code, it is recommended that the FORTRAN source be first structured with either *PRO_STRUCT* or *FOR_STRUCT* and then translated to C.

In summary, *FOR_C* does a good job at translating FORTRAN source code into readable C code. Though *FOR_C* is almost like a compiler, it does not attempt to produce optimized C code. That job is left to the C compiler and to the experienced C programmer. It may very well be that an experienced C programmer can produce more efficient C code by restructuring and rewriting the application using the powerful syntax of C. However, if you only need to translate existing and reliable FORTRAN into working C code, then *FOR_C* can save you much time and effort. And that, after all, is what computers are for.

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[3] *FOR_C Manual*, Cobalt Blue, San Jose, CA (1991), 291 pages.

[4] Kernighan, B. W., and Ritchie, D. M., *The C Programming Language*, Prentice Hall (1988), 272 pages.

[5] Vouk, M. A., *Multidimensional Arrays on C*, Computer Science Technical Report No. TR-89-08, North Carolina State University (1989), 25 pages.

Inside the AMS

AMS Planning Update: The Operational Plan

Over a year ago, the Society undertook a strategic planning process to examine the wide array of issues facing the membership and the wider mathematical community and to consider how the Society might address those issues. This process provided a mechanism by which the AMS could achieve consensus and plan its actions, rather than simply reacting on an ad hoc basis to problems that arose. In addition, the stategic planning process presented an opportunity to take a comprehensive look at what the AMS is doing and why, what it should be doing in the future, and how it can increase its effectiveness.

In mid-1991, the thirteen-member Strategic Planning Task Force (SPTF) produced a report which elucidated the mission of the Society and set forth a number of long-term goals. Although there were some grumbles about "bureacratese" in the report, it was on the whole well-received: there appears to be a general consensus that the problems identified and the goals set forth were well considered. In particular, the AMS Council approved the report with only a minor change to the reinterpretation of the Society mission statement that appeared in the report. (The report appeared in the July/August 1991 issue of the *Notices*, pages 573–582.)

What has happened since then? The Society formed six working groups, consisting of AMS staff and members, to flesh out the details of the six goals outlined in the report. Each group concentrated on one goal, examining what the Society is doing currently that supports the goal and discussing new projects relating to the goal. Having the complementary input of the staff and the membership was important in this discussion stage. Each group culled from its discussions recommendations which were subsequently examined, refined, and shaped into an operational plan. The plan was endorsed by the AMS Long Range Planning Committee and the Executive Committee and Board of Trustees (ECBT), and was then sent to the AMS Council.

Although it draws on ideas set forth in the SPTF report, the operational plan differs in that it contains more specifics about exactly how the AMS will start to implement the strategic plan, with individuals named as responsible for carrying out various tasks, specific dates by which tasks are to be completed, and budget details spelled out. In addition, one section of the document describes a development plan for ways to generate revenue and raise funds for the activities described in the operational plan. Following the AMS mission statement is an outline of some of the major plans and projects associated with each goal.

AMS Mission Statement

The AMS, founded in 1888 to further the interest of mathematical research and scholarship, serves the national and the international community through its publications, meetings, advocacy, and other programs which

- promote mathematical research, its communication, and uses,
- encourage and promote the transmission of mathematical understanding and skills,
- support mathematical education at all levels,
- advance the status of the profession of mathematics, encouraging and facilitating full participation of all individuals, and
- foster an awareness and appreciation of mathematics and its connections to other disciplines and everyday life.

Mathematical Research

Goal I: *Articulate and advocate an agenda that advances the quality and vitality of mathematical research.*

Advocacy

One of the major projects associated with this goal is the establishment of an AMS office in Washington, DC. The office will help the AMS to forge closer ties with Congress and the Executive Branch and other groups having an interest in research in the mathematical sciences, as well as to promote public awareness of the importance and usefulness of mathematics research. The Associate Executive Director for Programs and Governmental and Public Affairs, John "Spud" Bradley, will administer the office with a small staff. They will coordinate their activities closely with other groups such as the Office of Governmental and Public Affairs of the Joint Policy Board for Mathematics (JPBM), the Conference Board of the Mathematical Sciences, and the two National Research Council boards, the Board on Mathematical Sciences and the Mathematical Sciences

Education Board. The AMS Washington office is slated to open this summer.

The Washington office will help develop mechanisms to allow the Society to respond effectively to issues facing the research community. Another project aimed at this objective is the formation of an Advisory Group for Government Affairs. In recent years, the Society has been called upon to respond quickly to various requests for information, endorsement, or advice—the preparation of the pilot assessment report for the House Committee on Science, Space, and Technology is one such example (that report appeared in the February 1992 issue of the *Notices*). Generally, the Society has appointed ad hoc committees to address such requests and will continue to do so, but it would be useful for the volunteer leadership to have a permanent committee that could provide timely advice and rapid response in such situations. This Advisory Group is one component of a long range agenda to advance the vitality and quality of mathematical research. The AMS Committee on Science Policy has been charged with the development of this agenda, which will be a major undertaking for the Committee during this year.

Professional Development

Another important objective relating to the mathematical research goal is the professional development of mathematicians. In recent years, there has been considerable debate within the mathematical community—and within academia more generally—about what kinds of activities are recognized and rewarded. Research is the primary yardstick by which achievement is measured, while activities like teaching, curriculum development, student advising, and outreach to other disciplines hold far less value. However, there has been pressure on the academic community to strike a better balance in how these activities are rewarded. To address these issues and make recommendations for change, the AMS has joined with the MAA and the Society for Industrial and Applied Mathematics (SIAM) to form a JPBM Committee on Recognition and Rewards. Chaired by Calvin Moore, Associate Vice President for Academic Affairs of the University of California, the committee met at the Joint Mathematics Meetings in Baltimore in January 1992. The Society is providing administrative support for this project and is seeking funding from a variety of sources.

Employment Issues

An issue of immediate concern to many in the mathematics community is the academic job market. The past couple of years have seen a continual worsening in the employment prospects for academic mathematicians, and all signs point to this year as being the worst yet. The tight job market is the result of many factors, such as state budget deficits, declining college enrollments, an influx of foreign mathematicians, and increases in the number of doctorates being produced. In 1991, the AMS appointed a task force to examine the employment picture and to make recommendations for actions the Society could take. The task force has met several times and will produce a final report in the Spring of 1992. As a longer-term objective, the Society plans to develop mechanisms for reducing the damaging effects that employment fluctuations have on young mathematicians.

Publications

Goal II: *Maintain and enhance the Society's publications program of high quality, timely research mathematics while positioning the program for growth and response to change.*

Constituting about three-quarters of the Society's revenue, the publications program is crucial to the functioning of the AMS. During the 1990s, the program must be prepared to respond to the implications of budget constraints on academic research libraries, the traditional core market for AMS publications. Electronic communications are creating new pressures for change in the publication and distribution process. And there is a need to broaden the kinds of publications the AMS produces to bring in new topics and new audiences. The ideas and proposals growing out of this goal are intended to stimulate examination of various components of the AMS publications program to insure its scientific and financial health.

Publications Review

This examination will include a review of current publications projects with attention to the mission and strategic plan of the Society and to financial concerns. The Associate Executive Director for Publications, Samuel M. Rankin, will call upon editorial committees, the Council, the Board of Trustees, and the membership for assistance in conducting this review. In particular, the review will examine the publications sent to the entire membership (the *Notices* and the *Bulletin*), the videotape program, and some of the newer, less established journals. In addition, the AMS will review its program of secondary publications, such as *Mathematical Reviews* (*MR*), *Current Mathematical Publications*, and MathSci. Although this is an area of publishing for which the Society is especially renowned, such expensive secondary publications are likely candidates for cuts as library budgets are further strained. A task force, chaired by the Executive Editor of *MR*, Gerald Janusz, will examine the content of the *MR* database and how well the journal serves the mathematical community. A report from the task force is expected sometime in 1993.

Acquisitions Efforts

A central part of any successful publishing operation is an effective acquisitions program. The Publications Division of the AMS, under Rankin's leadership, has been restructured to increase acquisitions efforts. In particular, the Society will, with the consultation of editorial boards, the Publications Committee, and the Council, begin to explore ways to expand the scope of AMS publications. One major objective is to develop more expository works that are aimed at the general scientific community and that make connections with the applications of mathematics; another is to publish high-quality graduate and upper-level undergraduate textbooks.

To bring these ideas to fruition, as well as to streamline and speed up the acquisitions process, closer ties will be forged between Society staff and the editorial committees. Marketing strategies will be coordinated with these expanded acquisitions efforts.

Electronic Communications

Electronic communications will have a significant impact on the Society's traditional publications and offer an opportunity to bring new and more effective methods of communicating mathematics. The AMS will examine various modes of electronic distribution of information, including the Society's existing electronic products, e-Math and MathSci, to determine their effectiveness and economic viability. In addition, the AMS will continue development of a system, now being designed at the *MR* office in Ann Arbor, that promises to provide a mechanism for electronic distribution of AMS publications and a common electronic environment to facilitate writing or mathematics papers when the collaborators are not all in one location; this system would also improve the editing process. To assist Society staff and the ECBT in keeping abreast of the rapid developments occurring in electronic publishing and communications, a Committee on Electronic Publishing and Communications will be formed.

Education and Applications

Goal III: *Encourage and facilitate the contributions that mathematicians can make to mathematics education and to the transfer of mathematical knowledge to other disciplines and to industry.*

Role of the AMS

Mathematics education has been a major concern within the community in recent years, and several new groups and organizations have been formed to address the need for reform in mathematics education. Although many mathematicians have contributed individually to these efforts, the role of the AMS in educational activities has not been clearly defined. One of the major goals of the Society over the next few years is to clarify this role and to facilitate the participation of mathematicians in educational activities. The AMS Committee on Education has been charged with developing a comprehensive plan that articulates the unique contributions that the AMS and mathematicians can make to education. In particular, the AMS has a special interest and expertise in the areas of graduate and postdoctoral education, professional development, and nurturing mathematically talented students at all levels. Changing the culture of the community to place greater value on educational activities is also an important component of these efforts, one which will be examined by the JPBM Committee on Recognition and Rewards (see Goal I). The work of both Committees will help to increase awareness in the community about the activities of other organizations involved in mathematics education and to promote cooperative activities.

Technology Transfer

Interdisciplinary research is another important area in which the AMS can play a pivotal role, not only in the area of promoting connections between mathematics and other disciplines, but also in increasing public awareness of the usefulness of mathematics. To this end, the Society is considering the establishment of interdisciplinary institutes—conferences that would promote the transfer of mathematical knowledge to other areas and generate informative exposition for the general public. Among the possible topics for such institutes are medical imagery and modeling, composite materials, the AIDS epidemic, and the environment. A discussion paper outlining ideas for the institutes was presented to the ECBT at its meeting in November 1991. Financial support is expected to come from a combination of registration fees, corporations, federal agencies, and private foundations. In addition, the Society is exploring the possibility of summer research conferences for undergraduate and graduate students that would provide early exposure to research in mathematics and to the importance of mathematics in facilitating progress in science and technology.

The Society is also planning to produce an annual publication reporting new achievements in mathematics. Tentatively titled "What's Happening in Mathematics," this booklet will describe some of the recent developments in mathematics research in the previous year or so. The booklet will be written in nontechnical language and will be suitable for lay readers with an interest in science and mathematics. Science writers, teachers, and policymakers are likely to find it particularly useful. The Society has secured a $25,000 grant from the Exxon Education Foundation to initiate publication of the booklet and is seeking additional support from other sources.

Internship Programs

Another project addressing the twin issues of education and outreach is the establishment of a program, administered by the AMS, that would serve as an information source and clearinghouse for internships for undergraduate and graduate students in government laboratories and industry. Such internships broaden students' perspectives of mathematics and increase these potential employers' appreciation of mathematically talented individuals. The AMS would lend national visibility that could help bring in students who would not ordinarily be aware of internship opportunities. The program could also include projects in academia that provide students with early experiences in research—one advantage of AMS administration would be to stimulate participation by faculty who might not normally be inclined to undertake the administration of this kind of project. Exploration of a planning grant for this project will be undertaken in 1992.

Underrepresented Groups

Goal IV: *Enhance the participation of underrepresented groups in mathematics and promote broad-based involvement in AMS activities.*

Complementing Existing Programs

Increasing the participation of underrepresented groups is a major issue confronting a number of academic disciplines. Creating mechanisims to develop the mathematical talent of such groups is an important goal of the Society. Presently, a number of groups are examining these issues, including two joint committees on which sit AMS representatives. The Society will start to work more closely with these groups to develop ideas for promoting success in mathematics among underrepresented groups. In addition, the Society will disseminate information about programs that are successful in supporting the advancement of underrepresented groups in mathematics and will plan special activities for them at Society meetings.

One development that will assist these efforts is a new Meetings Committee, an overarching body that will create a coordinated plan for annual, summer, and sectional meetings to insure that these meetings are addressing the needs of a broad spectrum of the membership. The Society will also develop ways to bring a wider segment of the membership into AMS activities. In particular, there will be increased efforts to increase the participation of international members on AMS committees and editorial boards.

Public Awareness

Goal V: *Increase public understanding of the benefits of the study of mathematics and how mathematics is critical to scientific and technological education, discovery, and advances.*

Increasing public awareness of mathematics has been a major concern of the mathematics community over the past decade. Increased news coverage of mathematics and the national spotlight on mathematics education have heightened public understanding, but there is still a great deal to be done. This goal will be supported primarily by several projects described earlier, such as the "What's Happening in Mathematics" booklet, the interdisciplinary institutes, and the AMS Washington office. In addition, the Society will, in cooperation with the public awareness efforts of JPBM, prepare a public relations/awareness plan. One component of this plan will be the establishment of a pool of AMS volunteers, writers, and speakers who can be called upon to provide information about mathematics to science writers, the general public, Congress, funding agencies, and other organizations.

A key aspect of public awareness is outreach to organizations having an interest in mathematics. To this end, the Society will systematically expand its interactions with the federal government, other professional organizations, and boards of the National Research Council. In addition, the Society must position itself to establish direct communication with the Office of Science and Technology Policy and other such organizations in order to insure that the Society have representation at important meetings and briefings. These activities will be carefully coordinated with JPBM's Office of Governmental and Public Affairs.

Management

Goal VI: *Renew AMS governance, management, and organization to optimize use of its resources and to enhance its ability to identify and respond to current and emerging needs.*

The AMS is a large and complex operation—it has a membership of nearly 30,000, a staff of over 250, and manages a major publishing operation. On top of this, the Society is attempting to position itself to respond more effectively to the crucial issues identified in the strategic plan. In addition, many forces are affecting the mathematics community and the AMS membership—demographic changes, economic conditions, computerization, and even world politics. These factors have created pressures on the governance, management, and operating style of the AMS. The organizational structure of the Society must be examined and renewed for the Society to be able to carry out its mission and respond to current needs.

Part of this examination includes an internal review that includes such matters as job training, staff development, budgeting, and so on. In addition, the Society has launched a major study of its committee structure in order to produce a plan for a more efficient committee system. Coordination among committees, as well as effective communication between staff and committees, is a major goal of this planning process. An ad hoc committee, chaired by Sylvia Wiegand of the University of Nebraska, has been charged with examining AMS committees and developing a plan for restructuring them. A first draft of their report is expected to be submitted to the ECBT in May 1992.

Looking to the Future

As it works toward the goals set forth in the strategic task force report, the Society will be developing annual operating plans. Members are encouraged to contribute their thoughts, comments, and ideas to the AMS staff or officers. A complete list of AMS officers and committee members may be found in the *Notices*, September 1991, pages 846–855. The committee that will have the most direct continuing involvement in future operational plans is the Long Range Planning Committee, currently chaired by M. Salah Baouendi of the University of California at San Diego. Comments may also be directed to the AMS staff member who served as project director for the strategic planning activity: Timothy J. Goggins, AMS, P.O. Box 6248, Providence, RI 02940-6248; telephone 401-455-4110; electronic mail tjg@math.ams.com.

Allyn Jackson
Staff Writer

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).

Research and Development in the FY 1993 Budget

In January, President Bush unveiled his budget proposal for Fiscal Year 1993, and once again, research and development, as well as education, were emphasized as major themes of the Administration's spending plans. Total federal spending on research and development would continue to grow, although at a slower rate than in the recent past. Most striking, however, is the acceleration of recent trends governing the structure of the R&D budget. Defense R&D continues to decline, basic research continues to grow, and federal science and technology efforts are increasingly organized into large interdisciplinary programs designed to improve economic competitiveness and advance other national goals.

The President proposes spending $76.3 billion on R&D in FY 1993, about 4 percent more than the amount being spent this year. Within that total, civilian R&D would rise by more than 7 percent, while defense R&D would increase by a mere 1 percent. Civilian R&D has been growing much faster than defense R&D in recent years and comprises over 40 percent of the total, up from 34 percent just four years ago.

The thaw in U.S.-Soviet relations and the subsequent breakup of the USSR, of course, made possible the gradual contraction of the defense budget. But substantial growth in civilian R&D does not represent a transfer of funds from the defense sector. The Budget Enforcement Act of 1990—which established separate spending caps on domestic discretionary, defense, and international spending—prevents this. Rather, increases for civilian R&D have to be secured through offsetting decreases in other domestic discretionary programs.

Despite vast unmet needs and increasingly active constituencies for non-R&D domestic spending, science and technology continue to be top priorities of both the Administration and Congress. This year, R&D will expand by 10 percent over the previous year, while total domestic discretionary spending will increase by only 4 percent, approximately the rate of inflation. The 7 percent increase in federal R&D proposed for next year will have to be carved out of a total domestic discretionary budget that will be held at this year's level.

Also, as in recent years, FY 1993 funding for basic research would increase at a higher rate than spending on applied R&D: 8 percent annual growth for basic research vs. 3 percent for applied R&D. Although this is partly a reflection of the overall decline of defense R&D, the difference in growth rates also holds for the non-defense portion of the R&D budget.

Among the highlights noted by the Administration in its civilian research and development budget request is an increase of over $600 million for individual investigators at the National Science Foundation, the Department of Energy (DOE), and the National Institutes of Health, to a total of $7.9 billion.

But big science also came out a winner. Spending on the Superconducting Super Collider would rise from $484 million this year to $650 million in FY 1993, while total R&D spending by DOE would rise by only 1 percent. The NASA space station would be provided with an additional $221 million, 11 percent more than is being spent this year, for a total FY 1993 budget of $2.25 billion.

FCCSET Initiatives

The most prominent feature of the FY 1993 R&D budget is the increasing degree to which the proposed increases are channeled into integrated, multi-agency research programs in areas of national interest. The interagency Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), through its committees, has developed coordinated research goals and strategies in four areas, two of them new this year: Global Change Research, now in its fourth year; High Performance Computing and Communications, now in its second year; Biotechnology; and Advanced Materials and Processing.

Just over $8 billion would be spent on these initiatives in FY 1993, an increase of nearly $850 million over current spending in these areas. Agency activities carried out in conjunction with these initiatives simultaneously support the missions of the sponsoring agencies and advance national goals in these areas.

The FCCSET process has clearly become one of the major determinants of the structure of the federal investment in R&D. According to Allan Bromley, Assistant to the President for Science and Technology, it "represents an innovative and extremely promising approach to the coordination and prioritization of federal research and development."

The eleven agencies participating in the U.S. Global Change Research Program are seeking to broaden understanding of the earth's climate system and enhance the scientific basis for policymaking associated with global and regional environmental issues.

The High Performance Computing and Communications Program, involving nine agencies, is designed to sustain and enhance U.S. leadership in computing and networking by supporting the underlying research and human resources needed to produce the next generation of high performance computing hardware and software. These technologies are also essential to finding solutions to a wide variety of fundamental scientific and engineering "grand challenge" problems, such as understanding and predicting atmospheric phenomena, decoding the human genome, and simulating the properties of new materials.

Advanced materials figure prominently in the various lists of technologies identified as critical to U.S. competitiveness and security. The Advanced Materials and Processing Program, with the support of ten agencies, is designed to develop and maintain U.S. leadership in materials science and technology and to accelerate commercialization of innovations in advanced materials. While synthesis, processing, and characterization comprise the bulk of materials R&D activities, significant efforts will also be devoted to theory, modeling, and simulation.

Similarly, biotechnology R&D at twelve agencies will be coordinated to ensure continued U.S. leadership in this area. The interagency research program will focus on environmental biotechnology, manufacturing and bioprocessing, and biotechnology applications in the fields of health, agriculture, and energy.

Mathematics and Science Education

A fifth FCCSET initiative focuses on mathematics and science education in support of reaching the fourth National Education Goal: U.S. students will be first in the world in mathematics and science achievement by the year 2000. The FCCSET Committee on Education and Human Resources undertook an analysis of existing federal programs in mathematics, science, and engineering education and set priorities for future spending. Over $2 billion would be devoted to these programs, an increase of 7 percent. While over half of the budget is spent on programs at the undergraduate and graduate levels, the FCCSET committee has designated the improvement of precollege education the highest priority and the target of most of the increased funding.

The committee has further identified enhancing the quality of instruction as the most important federal policy to improve mathematics and science education. The Department of Education, the National Science Foundation, and other agencies would optimize funding in this area in FY 1993, providing enhancement programs for nearly half of the Nation's precollege mathematics and science teachers.

The Department of Education has asked for a 10 percent increase over FY 1992 levels, the largest such increase for any federal department. Within this amount, mathematics and science education programs would be expanded by 18 percent. The proposed budget includes many elements of AMERICA 2000, the President's blueprint for education reform, including programs to assist states redesign their curriculum and assessment systems.

National Science Foundation

The President included in his budget request an 18 percent increase for the National Science Foundation (NSF), keeping the agency on track toward a doubled budget by FY 1994. The $3 billion budget includes $2.2 billion for Research and Related Activities, up 17.9 percent over FY 1992; $480 million for the Education and Human Resources Directorate, up 3.1 percent; and $33 million for Academic Research Facilities and Instrumentation, which NSF would like to devote solely to instrumentation. The remainder would be spent on administrative functions and the U.S. Antarctic Program.

FY 1993 funding for the NSF research directorates would be tilted toward the FCCSET research initiatives. Within the $336 million increment for research, $200 million is associated with spending increases for the four interagency research programs.

NSF is also engaged in two internal initiatives: one in environmental science and one in advanced manufacturing, which is presently the focus of a FCCSET committee and will likely be an interagency activity in FY 1994. Including the current FCCSET programs, research in support of these six initiatives would account for 53 percent of the overall NSF research budget in FY 1993.

The budget request calls for 16.5 percent annual growth for the Mathematical and Physical Sciences Directorate, the lowest proposed percentage increase of any of the research directorates. Moreover, $41 million of the $103 million increment would be dedicated to major research equipment.

Spending by the Division of Mathematical Sciences (DMS) would increase by 8.1 percent, for a total of just under $85 million. Reflecting the priorities of the overall federal R&D effort, most of the $6.37 million increment would be used to enhance the participation of the mathematical sciences in the FCCSET and NSF initiatives. DMS also plans to expand funding for postdoctoral fellowships and for undergraduate curriculum development. Support for disciplinary research in mathematics would be held at its current level of about $48 million.

A more detailed description of the NSF budget for FY 1993 will appear in the April issue of the *Notices*.

Mathematical Sciences in Federal R&D

While the shift in federal R&D priorities toward activities associated with specific problems and challenges in science

and technology will continue to impinge on funding for disciplinary mathematics, the federal research initiatives provide growing and attractive opportunities for the mathematical sciences. The mathematical sciences have an important role to play in each of the FCCSET and NSF initiatives. The Division of Mathematical Sciences will continue to see that the mathematical sciences are fairly represented in the multi-agency, integrated research and education endeavors.

Furthermore, opportunities at agencies that do not systematically support the mathematical sciences have not been well exploited by the mathematical sciences community. The Environmental Protection Agency and the National Institutes of Health, for instance, fund research in the mathematical sciences, as does the Department of Transportation, where recent legislation has expanded R&D, most notably in the area of intelligent vehicle/highway systems research.

A list of phone numbers for obtaining documents describing the goals and priorities of the five FCCSET initiatives is provided:

Advanced Materials and Processing
National Institute of Standards and Technology
202-975-2762

Biotechnology Research Initiative
Department of Health and Human Services
202-245-6867

U.S. Global Change Research Program
National Science Foundation
202-357-9498

High Performance Computing and Communications
National Science Foundation
202-357-9498

Mathematics and Science Education Initiative
Department of Energy
202-586-5806

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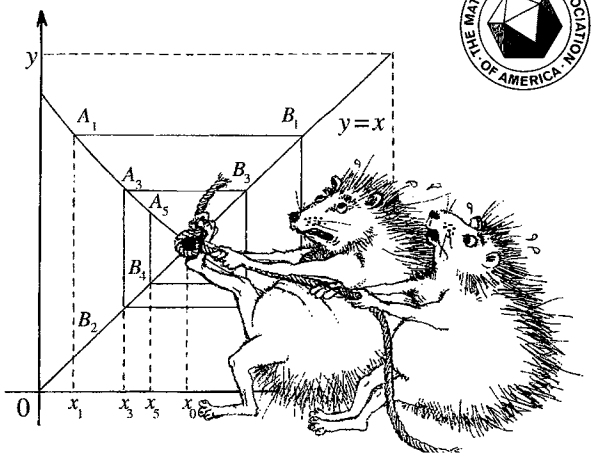

1991 *Mathematics Subject Classifications*: 01, 54
ISBN 0-8218-9000-X, 77 pages (softcover), December 1991, Individual member $19, List price $24
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News and Announcements

de Gennes Receives Nobel Prize in Physics

On December 10, 1991, The Royal Swedish Academy of Sciences awarded Pierre-Gilles de Gennes the Nobel Prize in Physics for his discovery that "methods developed for studying order(ing) phenomena in simple systems can be generalized to more complex forms of matter, in particular, to liquid crystals and polymers."

de Gennes is widely credited with launching remarkable, world-wide advances, clearly evident since 1969, in the physics of complex systems such as liquid crystals and polymers. Through his research and teachings, he has influenced both the direction and style of contemporary physics research in systems previously thought by some to be too complex for physics. In particular, in the words of the Swedish Academy, "He has shown that phase transitions in such apparently widely-differing physical systems as magnets, superconductors, liquid crystals, and polymer solutions can be described in mathematical terms of surprisingly broad generality." de Gennes' work is characterized by profound physical insight, minimum formalism, and maximum economy and simplicity.

de Gennes has an outstanding talent for encouraging cross-disciplinary scientific interactions and is a strong advocate of the synergism generated by close collaborations between theoretical and experimental researchers. His three books, *Superconductivity in Metals and Alloys* (1966), *Physics of Liquid Crystals* (1976, 1984), and *Scaling Concepts in Polymers* (1979) are striking in their lucidity, contain original ideas, and provide a solid basis in physical thinking for researchers and students to build new knowledge. His most recent book, *Introduction to Polymer Dynamics* (1990), provides a unified theoretical framework as a guide for future experiments in a variety of nonlinear phenomena such as polymer dynamics, protein chain folding, wetting and drag reduction.

Pierre-Gilles de Gennes was born October 24, 1932 in Paris, France. Although his early preferences were towards literary disciplines, the influence of several gifted teachers at the lycée Claude-Bernard, Paris, caused him to choose to specialize in science. At the Ecole Normale Supérieure, Paris (1951–1955), de Gennes was notably influenced by Professors Yves Rocard, Alfred Kastler (Physics Nobel Prize 1966), and Pierre Aigrain. After receiving *l'agrégation de physique*, de Gennes accepted a position as engineer at the Center for Atomic Studies, Saclay. Under the aegis of luminaries such as André Herpin and Anatole Abragam, he received the doctorate degree in 1957 with a Thèse d'Etat on the theory of neutron scattering by magnetic materials. The following year, he worked with Charles Kittel at the University of California at Berkeley.

In 1961, following completion of his French military service, de Gennes became professor of physics at the University of Paris-Sud, Orsay, and formed The Orsay Superconductivity Group (1961–1967). One of de Gennes' contributions to superconductivity was his prediction of neutron scattering by vortex lines in type-II superconductors. Another was his prediction for the persistence of superconductivity on the surface of type-II materials above the critical magnetic field to drive the bulk of the material into the normal state.

Around 1968, de Gennes became interested in liquid crystals, liquid states of some organic materials characterized by long range orientational order. One of the ordered phases of liquid crystals is the "nematic" phase, in which the molecules move as in an ordinary 3-dimensional liquid state, but with their long axes mainly parallel to each other defining a direction of long range orientational order. Other phases are termed "smectic": the molecules are arranged in layers with a degree of freedom in the plane of the layers that characterizes the particular smectic phase. In smectic A, for example, the direction of long range orientational order is parallel to the layer normal and molecules move freely in the plane of the layers. To launch the study of liquid crystals, de Gennes formed The Orsay Liquid Crystal Group (1969-1972). One of his first contributions was to explain the translucence of nematic liquid crystals as arising from local fluctuations in orientational order. With this new understanding, he showed that, *inter alia*, the Leslie-Ericksen viscosity coefficients could be obtained from light scattering experiments.

de Gennes was the first to apply the order parameter concept, invented by Landau (1937), to describe phase transitions in liquid crystals. An order parameter is a field variable, a function of space and time that characterizes the symmetry and dimensionality of the ordered (usually, lower temperature) phase. Its power rests on a deep truth:

symmetry cannot change continuously even if the magnitude of the order parameter can. Second order (continuous) phase transitions are often called "symmetry breaking" because the disordered state has more symmetry than the ordered state. For example, an isotropic liquid has 3-dimensional continuous rotational symmetry, whereas nematic liquid crystals orientationally order along one spatial direction (called the director): the nematic breaks continuous rotational symmetry of the isotropic liquid. de Gennes formulated theories for the nematic-isotropic phase transition that included predictions for how orientational order grows in the isotropic liquid as the transition temperature to the nematic state is approached.

The smectic A state is layered with the director parallel to the layer normal: the continuous translational order of the nematic is broken in smectic A. When de Gennes developed the free energy functional to describe the nematic-smectic A phase transition, he noted it had similarities to the Ginzburg-Landau description for the normal metal-superconducting transition. Because smectic A and superconductors both have two-component order parameters, they belong to the same universality class of critical phenomena. However, because the correlation length for the liquid crystal system is much smaller than for superconductors, de Gennes correctly predicted that its critical regime, the domain of nonlinear scaling concepts, is much wider, making the nematic-smectic A transition an ideal model system to test the validity of many ideas of critical phenomena. Predictions based on de Gennes' theory for the nematic-smectic A phase transition have been largely confirmed by many experiments around the world.

In 1971, de Gennes was named Professor for the most distinguished French Chair in Condensed Matter Physics at the Collège de France and began to concentrate on polymer physics. In 1975, he played a key role in creating still another collaborative group, Strasacol, formed by the Center for Macromolecular Research, Strasbourg, the high resolution neutron scattering group at Saclay, and his group at the Collège de France.

A polymer is considered a flexible chain with N identical links having an extension R_N, where R_N is defined as the distance between the two ends of the chain. In a random walk model (no interactions), ${R_N}^2 \sim N$. The self-avoiding random walk (repulsive interactions) in which each lattice site can be occupied only once, is used to model the excluded-volume polymer chain problem. In the limit of large N, this problem is intractable and, in earlier days, had elicited a host of theories with widely different predictions. de Gennes pointed out that, taking n, the number of components for an order parameter in phase transitions, to be *zero*, the excluded volume problem was isomorphic to critical phenomena. Experts in critical phenomena, notably Toulouse and Pfeuty, consider this observation an exceptionally elegant synthesis: *in one stroke the excluded-volume problem is linked to phase transitions while the physically significant range of n is enlarged.* It raised further questions about negative values for n and suggested that critical exponents are *continuous* functions of n.

Molten polymers flow like highly viscous ordinary liquids when acted upon by perturbations slower than a characteristic time, τ, and behave like a rubber at slightly higher frequencies. Experimentally, τ is found to scale like N^a with $a \sim 3$. A coherent theoretical estimate for a was first given by de Gennes with a simple reptation model, in which, at a given instant, to avoid neighboring chains, every chain is confined to a "tube" of length $L \sim N$. The chain moves inside its tube like a snake with a characteristic mobility inversely proportional to its length (i.e. $\sim 1/N$). Mobility is proportional to a diffusion constant, D_{tube}. de Gennes defined τ as the time for the chain to move the length of the initial tube: $\tau \stackrel{\text{def}}{=} L^2/D_{tube} \sim N^3$. The reptation concept led Doi and Edwards to a detailed theory of polymer dynamics that explains a significant fraction of the experimental data, not only for small deformations, but even in the nonlinear regime, making linear polymers novel model systems for rheology.

In 1976, in parallel with his other duties, de Gennes became Director for the Ecole Supérieure de Physique et Chimie (Ville de Paris). de Gennes was elected to l'Académie des Sciences in 1979, and is a member of many other scientific organizations and distinguished academies around the world. He has received numerous prizes and awards, such as the Centre National de la Recherche Scientifique Gold Medal (1979), The Ampère Prize of l'Académie des Sciences (1977), the Lorentz Medal (1991), and the Wolf Prize for Physics (1990). The award of the 1991 Nobel Prize in Physics to Pierre-Gilles de Gennes is clear recognition of his outstanding achievement in bringing physics to complex systems and complex systems to physics.

P. E. Cladis
AT&T Bell Laboratories
Murray Hill, New Jersey

MAA Prizes Awarded in Baltimore

The Mathematical Association of America (MAA) awarded a number of prizes during the Joint Mathematics Meetings in Baltimore in January of this year.

LYNN ARTHUR STEEN of St. Olaf College received the MAA's Yueh-Gin Gung and Dr. Charles H. Hu Award for Distinguished Service. The award consists of $4000 and a gold cup. A citation honoring Steen appeared in the January 1992 issue of the *American Mathematical Monthly.*

Steen received his bachelor's degree in mathematics and physics from Luther College and his doctorate in mathematics from the Massachusetts Institute of Technology. He has served as the President of MAA, Chair of the Conference Board of the Mathematical Sciences, and Chair of the Council of Scientific Society Presidents. In addition, he was a member of the National Council of Teachers of Mathematics Commission on Standards for School Mathematics, and a founding member of the Mathematical Sciences Education Board of the National Research Council.

One of Steen's best-known and most influential works is the report "Everybody Counts: A Report to the

Nation on the Future of Mathematics Education," published by National Academy Press in 1989. He has written numerous other reports, opinion columns, articles, and books. As the citation in the *Monthly* reads, "whether we are dealing with issues in mathematics today or mathematics tomorrow, the influence of Lynn A. Steen will have continuing impact. There is every evidence that he is just reaching his stride, and we can all look forward to still more significant contributions in the years ahead."

STEVEN G. KRANTZ of Washington University in St. Louis received the MAA's Chauvenet Prize for his paper, "What is Several Complex Variables?" (*American Mathematical Monthly*, vol. 94, 1987). The Chauvenet Prize is presented to the author of a noteworthy expository or survey paper and includes a cash award of $1000.

The committee that chose Krantz for the prize noted that "several complex variables is a broad subject which enjoys symbiotic relationships with a surprisingly wide range of other parts of mathematics... [Krantz's paper is] an attractively written account which illustrates a number of these interconnections and offers self contained proofs of several gems in the subject." Krantz is the author of several books on real analysis and complex variable theory. He received his bachelor's degree from the University of California at Santa Cruz and his doctorate from Princeton University.

The MAA also awarded a number of Certificates for Meritorious Service to the MAA and its sections. The recipients are: JAMES C. BRADFORD, Abilene Christian University, Abilene, Texas; FRANK S. BRENNEMAN, Tabor College, Hillsboro, Kansas; ROBERT GILMER, Florida State University, Tallahassee, Florida; A. DUANE PORTER, University of Wyoming, Laramie, Wyoming; and JAMES T. TATTERSALL, Providence College, Providence, Rhode Island.

Reissner Named Honorary Member of ASME

Eric Reissner, professor emeritus of applied mechanics at the University of California at San Diego, has been named Honorary Member of the American Society of Mechanical Engineers (ASME), an award bestowed for lifetime service to engineering. Reissner was cited "for his profound and lasting mark on international applied mechanics through over half a century of teaching, 300 research papers, and wise counsel at the highest levels of ASME."

Reissner received a Dipl. Ing. (1935) in applied mathematics and a Dr. Ing. (1936) in civil engineering from the Technical University Berlin, Germany, and his Ph.D. in mathematics (1938) from the Massachusetts Institute of Technology. He was on the mathematics faculty at MIT until 1970, when he moved to the University of California at San Diego as a professor of applied mechanics. He was named professor emeritus in 1978.

New AWM Executive Director

Jodi Beldotti has accepted the post of executive director of the Association for Women in Mathematics (AWM). Prior to coming to AWM, she was working on a temporary basis at Thinking Machines Corporation. Beldotti has also taught mathematics, specializing in adult basic education and in teaching mathematics to students learning English as a second language. In addition, she owns a business called Concepts in Organization, which helps small businesses streamline their paperwork systems and does software documentation. Her predecessor, Patricia N. Cross, left AWM in November 1991 to take a position as the meetings and events manager of a law firm in Boston. Beldotti can be reached at: Association for Women in Mathematics, Box 178, Wellesley College, Wellesley, MA 02181; electronic mail jbeldotti@lucy.wellesley.edu.

AMS Receives Exxon Grant

The Society has received a $25,000 grant from the Exxon Education Foundation to help launch a new yearly publication that will describe some of the major recent developments in mathematics. Tentatively titled "What's Happening in Mathematics," the booklet will describe some of the recent developments in mathematics research in the previous year or so. The booklet will be written in nontechnical language and will be suitable for lay readers with an interest in science and mathematics. Science writers, teachers, and policymakers—as well as mathematicians who are curious about developments in areas other than their own—are likely to find it particularly useful. In addition to the Exxon grant, the AMS is seeking additional support for the booklet from other sources.

Special AMS Individual Member Rate on North-Holland Mathematics Books

Elsevier Science Publishers, publisher of some 650 journals, more than 8000 books, and scientific information in electronic databases and on CD-ROM, announces a 25% discount off the list price on its mathematics books for the individual members of the American Mathematical Society as of March 1992. Individual members of the American Mathematical Society should include with their prepaid orders their membership code and send these directly to the publisher.

The North-Holland imprint covers all areas of mathematics. The mathematics book program includes such well-known series as the North-Holland Mathematical Library, North-Holland Mathematics Studies, and Studies in Logic and the Foundations of Mathematics.

The mathematics journal program includes significant journals such as the *Journal of Pure and Applied Algebra* and *Topology and its Applications*. For further information please contact Elsevier Science Publishing Co. Inc., attn: Judy Weislogel, 655 Avenue of the Americas, New York, NY 10010-5107, FAX 212-633-3880 or Elsevier Science Publishers, attn: Marijcke Haccou, P.O. Box 103, 1000 AC Amsterdam, The Netherlands, FAX (31) (20) 5862616.

News from the Fields Institute for Research in Mathematical Sciences

The research program at the Fields Institute through July 1992 is Control Theory, focusing on stabilization, control, and design of flexible structures

and the control of mechanical systems. The program committee consists of B. Francis, I.A.K. Kupka, J.E. Marsden, W.F. Shadwick, and G. Zames.

Short- and long-term visitors during the Control Theory program include: J. Baillieul (Boston Univ.), A. Bloch (Ohio State Univ.), P. Crouch (Arizona State Univ.), R.B. Gardner (Univ. of North Carolina), V. Jurdjevic (Univ. of Toronto), I.A.K. Kupka (Univ. of Toronto), A. Krener (Univ. of California, Davis), P.S. Krishnaprasad (Univ. of Maryland), R. Montgomery (Univ. of California, Santa Cruz), K. Morris (Univ. of Waterloo), D. Wang (Univ. of Waterloo), G. Wilkens (Univ. of Hawaii).

Workshops are being planned in: Molecular Control, organized by A. Pierce (McMaster Univ.) and M. Dahleh (Univ. of California, Santa Barbara); Hamiltonian and Gradient Flows and Algorithms, organized by A. Bloch (Ohio State Univ.); Geometric Variational Problems and Optimal Control, organized by V. Jurdjevic and I. Kupka (Univ. of Toronto) and W.F. Shadwick (Univ. of Waterloo); and Space Structures, organized by K. Morris (Univ. of Waterloo).

For more information about these workshops or other activities of the Institute contact E. Reidt, The Fields Institute for Research in Mathematical Sciences, 185 Columbia St. West, Waterloo, Ontario, Canada N2L 5Z5; 519-725-0096; Fax: 519-725-0704; email: workshop@fields.waterloo.edu.

New Mathematics Journal from Yugoslavia

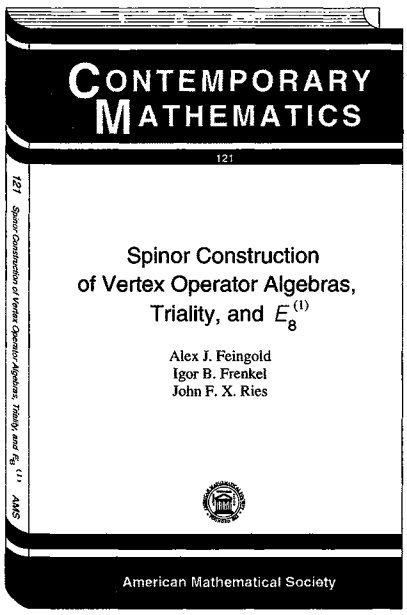
The Department of Mathematics of the University in Titograd and the Society of Mathematicians and Physicists of Montenegro are starting a journal entitled *Mathematica Montisnigri.* The journal will carry research papers in all areas of mathematics. There will be two issues per year, with the first issue to appear in mid-1992. Those wishing more information can contact the editor, Prof.dr. Žarko Pavićević, Prirodno-matematički Fakultet - Titograd, 81000 Titograd, Cetinjski put bb, Pošt. fah. 176, Yugoslavia.

Symposium on Human Resources

Will the U.S. be ready to compete? *Preparing for the 21st Century: Human Resources in Science and Technology,* is the ninth biennial symposium on human resources in science and technology, sponsored by the Commission on Professionals in Science and Technology (CPST, formerly the Scientific Manpower Commission). The symposium, partially funded with a grant from the Alfred P. Sloan Foundation, will take place on March 26-27, 1992 in Washington, DC. Experts will examine the complete picture of the future workforce, beginning from its education through its employment in all sectors: industry, academe, and government; the emerging foreign national issue; and the global workforce.

Among the many expert speakers will be D. Allan Bromley, the President's Science Advisor, Erich Bloch, former director of the National Science Foundation, John Lyons, Director of the National Institute of Standards and Technology, Barbara Bergman, President of the American Association of University Professors, and immigration law expert, Charles C. Foster. Janet Halliwell, Chairman of the Science Council of Canada, will be the dinner speaker, and Dan Greenberg, Editor, *Science and Government Report,* will be a luncheon speaker.

The Vista Hotel will be the sight of the two-day symposium. Advance registration is $200 for CPST members and $260 for nonmembers. Further information is available from the CPST at 1500 Massachusetts Ave, NW, Suite 831, Washington, DC 20005, 202-223-6995.



Spinor Construction of Vertex Operator Algebras, Triality, and $E_8^{(1)}$

Vol. 121

Alex J. Feingold, Igor B. Frenkel, and John F. X. Ries

Directed at mathematicians and physicists, this book is accessible to graduate students with some background in finite-dimensional Lie algebras and their representations.

The reader will learn how the concepts and techniques of Lie theory can be generalized to give the algebraic structures associated with conformal field theory. The careful reader will gain a detailed knowledge of how the spinor construction of classical triality lifts to the affine algebras, and plays an important role in a spinor construction of vertex operator algebras, modules and intertwining operators with nontrivial monodromies.

1991 *Mathematics Subject Classifications*: 17, 81
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Funding Information for the Mathematical Sciences

1993-1994 Fulbright Competition Opens

The Fulbright Scholar Program for 1993-1994 includes some 1000 grants for research, combined research and lecturing, or university lecturing in over 120 countries. Opportunities range from two months to a full academic year, and many assignments are flexible to the needs of the grantee.

The basic eligibility requirements are U.S. citizenship and a Ph.D. or comparable professional qualifications. For lecturing awards, university or college teaching experience is expected. Language skills are needed for some countries, but most lecturing assignments are in English. Applications are encouraged from professionals outside academe and from independent scholars. The program seeks good teachers as well as active researchers.

The deadlines for applying are **June 15, 1992** for Australasia and South Asia, and **August 1, 1992** for Africa, Asia, Europe, Latin America, the Middle East, and Canada. There are other deadlines for special programs.

For further information and applications, contact: Council for International Exchange of Scholars, 3007 Tilden Street, NW, Suite 5M, Box NEWS, Washington, DC 20008-3009; telephone 202-686-7877.

1993-1994 Advanced Research Fellowships in India

The Indo-U.S. Subcommission on Education and Culture is offering nine long-term (six to ten months) and nine short-term (two to three months) awards for research in India during the 1993-1994 year. The fellowship program seeks to open new channels of communication between academic and professional groups in the U.S. and India and to encourage a wider range of research activity than now exists. Scholars and professionals with limited or no prior experience in India are especially encouraged to apply.

Applicants must be U.S. citizens and hold the Ph.D. or have comparable professional qualifications. The application deadline is **June 15, 1992**. For further information and applications, contact: Council for International Exchange of Scholars, 3007 Tilden Street, NW, Suite 5M, Box INDO, Washington, DC 20008-3009; telephone 202-686-7877.

MEMOIRS of the American Mathematical Society

New Titles!

Vol. 456

Combinatorial Patterns for Maps of the Interval
Michal Misiurewicz and Zbigniew Nitecki

This study investigates new features of the relation between cyclic permutations and its generalization to multicyclic permutations and combinatorial patterns.

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ISBN 0-8218-2513-5, 120 pp. (softcover), November 1991
Indiv. mem. $13, List $21, Inst. mem. $17
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Vol. 457

Multiplicative Homology Operations and Transfer
Norihiko Minami

In *Multiplicative Homology Operations and Transfer*, Minami presents a completely new treatment of the homology operations QS^0.

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Vol. 458

Lyapunov Theorems for Operator Algebras
Charles A. Akemann and Joel Anderson

This book presents the result of a systematic generalization of Lyapunov's theorem to the setting of operator algebras.

1991 *Mathematics Subject Classifications*: 46; 28, 49, 52, 60, 93
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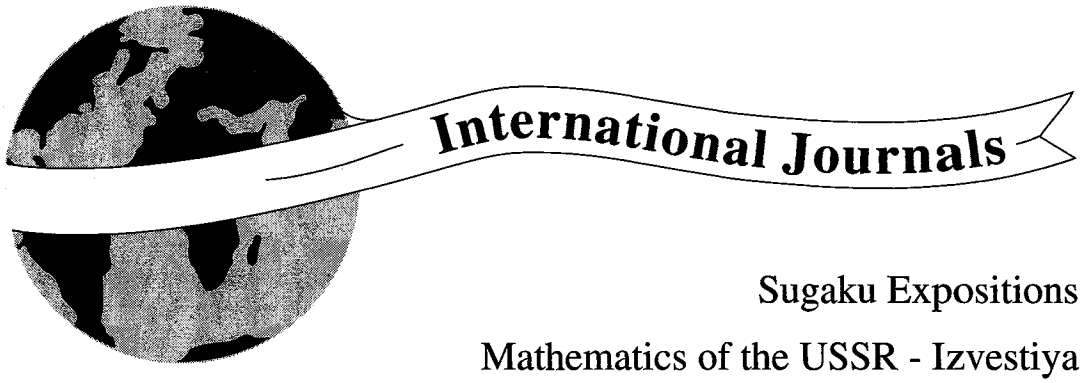

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Theory of Probability and Mathematical Statistics

St. Petersburg Mathematical Journal*
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Tuscaloosa, Alabama
University of Alabama
March 13–14, 1992

Program

The eight-hundred-and-seventy-second meeting of the American Mathematical Society (AMS) will be held at the University of Alabama, Tuscaloosa, Alabama on Friday, March 13, and Saturday, March 14, 1992. All sessions will be held in the Paul W. Bryant Conference Center.

Invited Addresses

By invitation of the Southeastern Section Program Committee, there will be four invited one-hour addresses. The speakers, their affiliations, and the titles of their talks where available are:

Jane M. Hawkins, University of North Carolina, Chapel Hill, *Invariant measures for noninvertible maps.*

Charles A. Micchelli, IBM, *Pyramid schemes for the recursive computation of multivariate polynomials.*

Serge Ochanine, University of Kentucky, Lexington, *What is elliptic cohomology.*

Peter M. Winkler, Bellcore, *Linear extensions of partially ordered sets.*

Special Sessions

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

Spectral theory of ordinary and partial differential operators, **Richard C. Brown**, University of Alabama, Tuscaloosa.

Infinite groups and group rings, **Jon M. Corson**, **Martyn Russell Dixon**, **Martin J. Evans**, **Frank Roehl**, University of Alabama, Tuscaloosa.

Ergodic theory and dynamical systems, **Karma Dajani**, University of South Alabama, **Jane M. Hawkins**, **Karl Petersen**, and **Mate Wierdl**, University of North Carolina, Chapel Hill.

Combinatorial problems or partially ordered sets, **Peter M. Winkler**, Bellcore.

Operator algebras, **Alan Hopenwasser**, and **Cecelia Laurie**, University of Alabama, Tuscaloosa.

Geometric topology, **Vo Thanh Liem**, and **Bruce S. Trace**, University of Alabama, Tuscaloosa.

Harmonic analysis and related topics, **Kai-ching Lin**, **Tavan T. Trent**, **James L. Wang**, and **Zhijian Wu**, University of Alabama, Tuscaloosa.

Approximation theory: Modern methods, **Charles A. Micchelli**, and **R. A. Zalik**, Auburn University.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Late papers will not be accommodated.

Registration

The meeting registration desk will be located in the main lobby of the Paul W. Bryant Conference Center. The registration desk will be open 8:00 a.m. to 4:00 p.m. on Friday, March 13, and 8:00 a.m. to 11:00 a.m. on Saturday, March 14. The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians.

Accommodations

Rooms have been blocked for participants at the Holiday Inn, LaQuinta Inn, and the Quality Inn. These Inns are adjacent to the exit off of I-20 and I-59 on McFarland Boulevard in Tuscaloosa. Morning and evening van transportation will be provided between these motels and the Bryant Conference Center. A block of rooms is also being held in Parker-Adams Hall, close to the President's Mansion on campus. This is a small, older residence hall that is now used only for conference participants and university visitors. In addition, a very limited number of rooms are available at Dill's Motor Court. Participants should make their own arrangements with the hotel of their choice and ask for the AMS meeting rate. All rates are subject to an eight percent tax. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

Holiday Inn (2.9 miles to Bryant Conference Center)
3920 McFarland Boulevard, Tuscaloosa, AL 35405
Telephone: 800-322-3489 or 205-553-1550
The deadline for reservations was February 11.

Double $46

La Quinta Inn (3 miles to Bryant Conference Center)
4122 McFarland Boulevard, Tuscaloosa, AL 35405
Telephone: 800-531-5900 or 205-349-3270
The deadline for reservations was February 19.
Double $44

Quality Inn
3801 McFarland Boulevard, Tuscaloosa, AL 35405
Telephone: 800-228-5151 or 205-556-9690
The deadline for reservations was February 11.
Single $39 Double $112 Triple $49

Dill's Motor Court (.6 miles to Bryant Conference Center)
521 University Boulevard, Tuscaloosa, AL 35405
Telephone: 205-758-7571
The deadline for reservations is March 10.
Double $41.75 Triple $45.75

Parke-Adams Hall (.4 miles to Bryant Center)
Reservations must be made by calling Sidney Hennessey at 205-348-2514. All rooms include linens. Advance payment is required and should be mailed to: Sidney Hennessey, Department of Housing, University of Alabama, P.O. Box 870399, Tuscaloosa, AL 35487.
The deadline for reservations is March 2.
Single $18 Double $26

Food Service

Bama Dining, located in Mary Burke Hall, will be open for breakfast (7:00 a.m. - 9:30 a.m.), lunch (11:15 a.m. - 1:30 p.m.), and dinner (4:30 p.m. - 6:30 p.m.) on Friday and for lunch only on Saturday. The dining room offers all you can eat with a good selection of items at a reasonable price. The Oak Room in the Sheraton Capstone Inn, adjacent to the Bryant Center, serves moderately priced lunches as well as a lunch buffet. A list of off campus restaurants will be available at the registration desk.

Parking

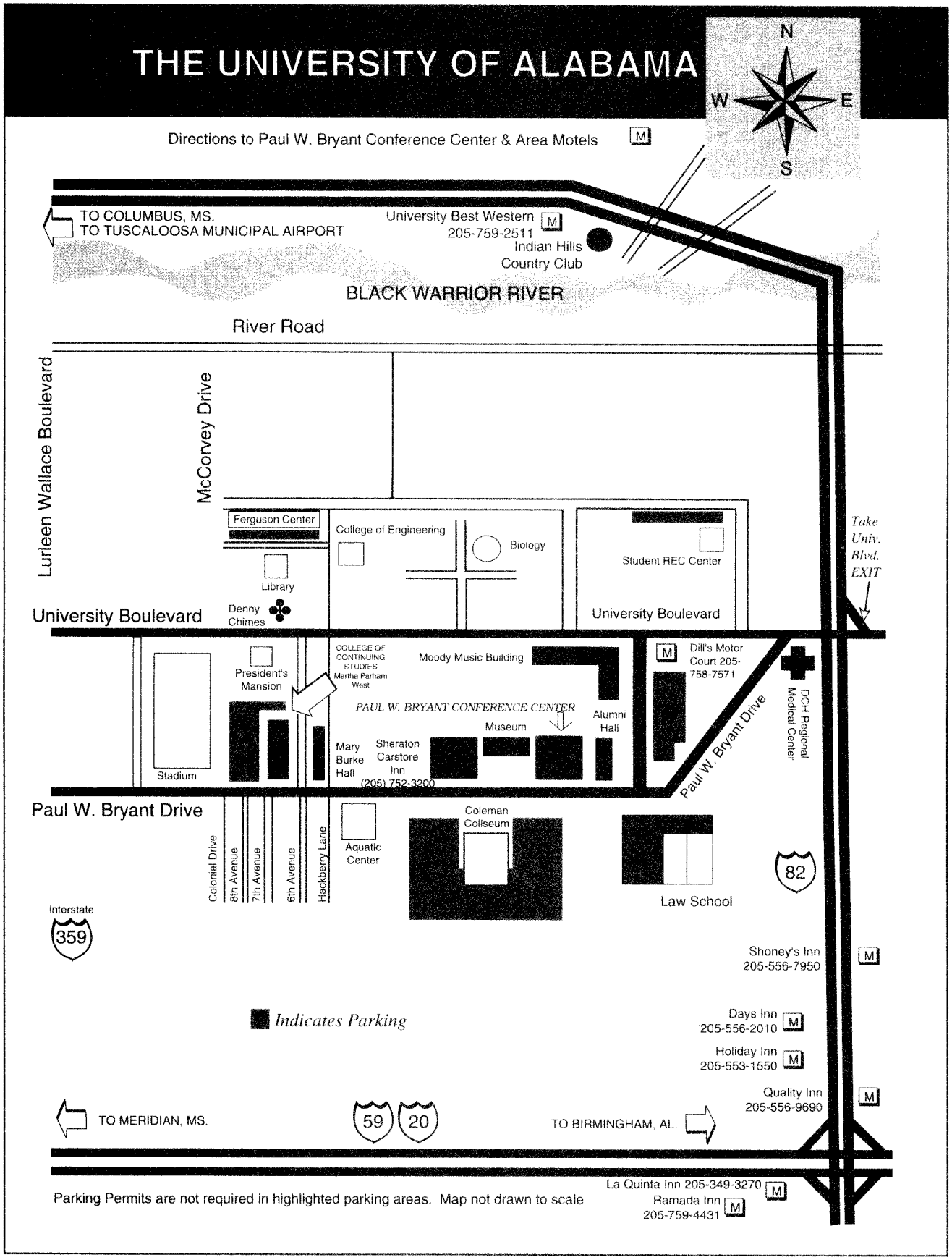
Free parking for the Bryant Conference Center is available in the lot at the corner of Paul Bryant Drive and Second Avenue. Participants staying at Parker-Adams Hall may obtain visitor parking permits from the University Police Department in Gorgas Hall located at the corner of University Boulevard and Stadium Drive or may park in the lot adjacent to the College of Continuing Education.

Travel and Local Information

Tuscaloosa is easily reached by car on Interstate 20/59. When arriving by car take exit 73 and follow McFarland Boulevard (U.S 82). The Tuscaloosa Airport is served by Atlantic Southeast Airlines (affiliated with Delta Airlines) from Atlanta and American Eagle (affiliated with American Airlines) from Nashville. Seats are limited and early reservations are recommended. The Birmingham Airport has more frequent service and is approximately a one hour drive from Tuscaloosa. AMTRAK provides daily passenger rail service to and from Tuscaloosa through Atlanta and New Orleans.

Weather

The weather in Tuscaloosa in March is variable. In a recent year, daily lows averaged 43°F and daily highs averaged 67°F. Rainfall in March can be heavy.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Program of the Sessions

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

Abstracts of papers presented in the sessions at this meeting will be found in the March 1992 issue of *Abstracts of papers presented to the American Mathematical Society*, ordered according to the numbers in parentheses following the listings below.

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

Friday, March 13

Special Session on Spectral Theory of Ordinary and Partial Differential Operators, I

9:00 a.m.–10:50 a.m. Thames, Bryant Conference Center

9:00 a.m. (1) *Poincare and Friedrichs inequalities in Banach function spaces.*
David Edmunds, University of Sussex, England (872-35-116)

9:30 a.m. (2) *Inverse problems for fractal drums.*
Jacqueline Fleckinger*, University of Toulouse I, France, and **Dimtri Vasilev**, University of Sussex, England (872-35-69)

10:00 a.m. (3) *Algebraic bounds on eigenvalue gaps.*
Evans M. Harrell, II, Georgia Institute of Technology (872-35-95)

10:30 a.m. (4) *Self-adjointness for the Weyl problem under an energy norm.*
Allan M. Krall, Pennsylvania State University, University Park (872-34-12)

Special Session on Infintite groups and group rings, I

9:00 a.m.–10:50 a.m. Mobile, Bryant Conference Center

9:00 a.m. (5) *Property σ in groups.*
James C. Beidleman*, University of Kentucky, and **D. J. S. Robinson**, University of Illinois, Urbana-Champaign (872-20-03)

9:30 a.m. (6) *Insolvable 5-rewritable groups.* Preliminary report.
Russell D. Blyth*, Saint Louis University, and **Derek J. S. Robinson**, University of Illinois, Urbana-Champaign (872-20-79)

10:00 a.m. (7) *Computer investigations in group rings.*
Donald B. Coleman, University of Kentucky (872-20-22)

10:30 a.m. (8) *On HNN-groups whose three generator subgroups are free.*
Benjamin Fine*, Fairfield University, **Frank Roehl**, University of Alabama, Tuscaloosa, and **Gerhard Rosenberger**, University of Dortmund, Germany (872-20-103)

Special Session on Combinatorial Problems on Partially Ordered Sets, I

9:00 a.m.–10:50 a.m. Central, Bryant Conference Center

9:00 a.m. (9) *Matchings in the partition lattice.*
E. Rodney Canfield, University of Georgia (872-06-120)

9:30 a.m. (10) *Graphs and posets.*
S. T. Hedetniemi and **Renu Laskar***, Clemson University (872-05-66)

10:00 a.m. (11) *On dimension in the cube.*
Glenn H. Hurlbert, Arizona State University (872-06-60)

10:30 a.m. (12) *Some variations on Winkler's τ-neighborhood problem.*
David P. Jacobs, Clemson University (872-03-81)

Special Session on Operator Algebras, I

9:00 a.m.–10:50 a.m. Rasta-A, Bryant Conference Center

9:00 a.m. (13) *The convolution algebra of a quantum group.*
Edward G. Effros*, University of California, Los Angeles, and **Zhong-Jin Ruan**, University of Illinois, Urbana-Champaign (872-46-132)

10:00 a.m. (14) *On singly generated operator algebras.*
Edward A. Azoff*, University of Georgia, and **Hasan Shehada**, Southern Arkansas University (872-47-133)

10:30 a.m. (15) *Triangular UHF algebras over arbitrary fields.* Preliminary report.
Richard L. Baker, University of Iowa (872-47-57)
(Sponsored by Margaret H. Kleinfeld)

Friday, March 13 (cont'd)

Special Session on Geometric Topology, I

9:00 a.m.–10:50 a.m. Birmingham, Bryant Conference Center

9:00 a.m. (16) *A triple point formula for knotted surface.* **J. Scott Carter***, University of South Alabama, and **Masahiko Saito**, University of Texas, Austin (872-57-47)

9:30 a.m. (17) *3-Manifolds with geometric structure and approximate fibrations.* **Robert J. Daverman**, University of Tennessee, Knoxville (872-57-07)

10:00 a.m. (18) *A maximally pathological Brouwer homeomorphism.* **Edward Warwick Daw**, University of California, Los Angeles (872-58-110)

10:30 a.m. (19) *Attractors of iterated function systems.* **P. F. Duvall***, University of North Carolina, Greensboro, and **L. S. Husch**, University of Tennessee, Knoxville (872-54-28)

Special Session on Harmonic Analysis and Related Topics, I

9:00 a.m.–10:50 a.m. Mason, Bryant Conference Center

9:00 a.m. (20) *On the $T(1)$ theorem on product domains.* **Josefina Alvarez**, New Mexico State University (872-42-37)

9:30 a.m. (21) *The area conjecture for plane Q.C. mappings.* **Albert Baernstein, II**, Washington University (872-30-87)

10:00 a.m. (22) *Martingale transforms and Hardy spaces.* **J.-A. Chao***, Cleveland State University, and **R.-L. Long**, Academia Sinica, People's Republic of China (872-42-19)

10:30 a.m. (23) *Singular integrals with highly oscillating kernels on the product domains.* **Lung-Kee Chen**, Oregon State University (872-42-51) (Sponsored by Quoshin Chi)

Special Session on Approximation Theory: Modern Methods, I

9:00 a.m.–10:50 a.m. Logan, Bryant Conference Center

9:00 a.m. (24) *Wavelet operators in approximation and probability.* **George Anastassiou**, Memphis State University (872-41-13)

9:30 a.m. (25) *n-widths in Hilbert spaces of analytic functions.* Preliminary report. **Stephen D. Fisher**, Northwestern University (872-41-39)

10:00 a.m. (26) *Pages from the computer files of R. William Gosper.* **M. E. H. Ismail***, University of South Florida, **Y. Takeuchi**, National University of Columbia, Columbia, and **R. Zhang**, University of South Florida (872-33-100)

10:30 a.m. (27) *Simultaneous approximation of functions and their derivatives by linear projections.* Preliminary report. **Theodore Kilgore**, Auburn University, Auburn (872-41-86)

Invited Address

1:00 p.m.–2:00 p.m. Rasta-A, Bryant Conference Center

(28) *Linear extensions of partially ordered sets.* **Peter M. Winkler**, Bellcore, New Jersey (872-06-76)

Special Session on Infintite groups and group rings, II

2:10 p.m.–4:30 p.m. Mobile, Bryant Conference Center

2:10 p.m. (29) *The combinatorial structure of some infinite groups related to finite simple groups.* **Thomas A. Fournelle*** and **Kenneth W. Weston**, University of Wisconsin, Parkside (872-20-04)

2:40 p.m. (30) *The universal theory of free groups.* Preliminary report. **Anthony M. Gaglione***, United States Naval Academy, and **Dennis Spellman**, Philadelphia, Pennsylvania (872-20-77)

3:10 p.m. (31) *Automorphisms and primitivity of relatively free gorups.* **C. Kanta Gupta**, University of Manitoba (872-20-09)

3:40 p.m. (32) *Dimension quotients of arbitrary groups.* **Narain Gupta**, University of Manitoba (872-20-08)

4:10 p.m. (33) *Integral group rings of finite representation type.* **Lee Klingler***, Florida Atlantic University, and **Jeremy Haefner**, University of Colorado (872-16-91)

Special Session on Ergodic Theory and Dynamical Systems, I

2:10 p.m.–4:00 p.m. Thames, Bryant Conference Center

2:10 p.m. (34) *A positive entropy annulus homeomorphism without periodic points.* **F. Botelho**, Memphis State University (872-58-45)

2:40 p.m. (35) *The dynamics of continuous maps on one-dimensional manifolds through inverse limits.* Preliminary report. **Marcy Barge**, Montana State University, and **Beverly Diamond***, College of Charleston (872-58-58)

3:10 p.m. (36) *Universal zero sets for sequence-entropy.* Preliminary report. **Jonathan King**, University of Florida (872-28-61)

3:40 p.m. (37) *Restricted orbit equivalence for Z^d-actions.* **Janet Kammeyer**, United States Naval Academy, and **Daniel Rudolph***, University of Maryland, College Park (872-60-124)

Special Session on Combinatorial Problems on Partially Ordered Sets, II

2:10 p.m.–5:00 p.m. Central, Bryant Conference Center

2:10 p.m. (38) *Bi-partitions and products of Young lattices.* Preliminary report.
David Robinson, Guilford College (872-06-29)

2:40 p.m. (39) *Phase transitions in partially ordered sets.* Preliminary report.
Bruce L. Rothschild*, University of California, Los Angeles, and **Peter M. Winkler**, Bellcore, New Jersey (872-05-118)

3:10 p.m. (40) *Generating linear extensions fast.*
Gara Pruesse, University of Toronto, and **Frank Ruskey***, University of Victoria (872-05-112) (Sponsored by Wendy J. Myrvold)

3:40 p.m. (41) *Monotone gray codes.* Preliminary report.
Carla D. Savage*, North Carolina State University, and **Peter M. Winkler**, Bellcore, New Jersey (872-06-122)

4:10 p.m. (42) *Posets with large dimension and relatively few critical pairs.* Preliminary report.
Peter C. Fishburn, AT&T Bell Laboratories, Murray Hill, New Jersey, and **William T. Trotter***, Bell Communications Research, New Jersey (872-06-123)

4:40 p.m. (43) *A basis for the homology of d-divisible partition lattices.*
Michelle L. Wachs, University of Miami (872-05-113)

Special Session on Operator Algebras, II

2:10 p.m.–5:00 p.m. Rasta-A, Bryant Conference Center

2:10 p.m. (44) *The crossed products of operator-algebras by operator convolution algebras.*
Edward G. Effros, University of California, Los Angeles, and **Zhong-Jin Ruan***, University of Illinois, Urbana-Champaign (872-46-73)

2:40 p.m. (45) *Morita equivalence of operator algebras.* Preliminary report.
David Blecher*, University of Houston, Downtown, **Paul Muhly**, University of Iowa, and **Vern Paulsen**, University of Houston, Downtown (872-46-89)

3:10 p.m. (46) *Spectra for compact group actions.*
Elliot C. Gootman*, University of Georgia, **Aldo J. Lazar**, Tel Aviv University, Israel, and **Costel Peligrad**, University of Cincinnati (872-46-54)

3:40 p.m. (47) *Recent results on operator means.* Preliminary report.
William L. Green, Georgia Institute of Technology (872-46-83)

4:10 p.m. (48) *Join-irreducibility of ideals in triangular UHF algebras.*
Timothy D. Hudson, Texas A&M University, College Station (872-46-80)

4:40 p.m. (49) *Operator equations in CSL algebras.* Preliminary report.
Elias G. Katsoulis, University of Alabama, Tuscaloosa (872-47-36)

Special Session on Geometric Topology, II

2:10 p.m.–5:00 p.m. Birmingham, Bryant Conference Center

2:10 p.m. (50) *Complexes that arise in cohomological dimension theory: A unified approach.* Preliminary report.
Jerzy Dydak*, University of Tennessee, Knoxville, and **John J. Walsh**, University of California, Riverside (872-54-16)

2:40 p.m. (51) *A higher Euler characteristic.*
Ross Geoghegan*, State University of New York, Binghamton, and **Andrew Nicas**, McMaster University (872-57-82)

3:10 p.m. (52) *Arrangements of real algebraic curves.*
Patrick M. Gilmer, Louisiana State University (872-57-06)

3:40 p.m. (53) *Non-collarable ends of 4-manifolds.*
Craig R. Guilbault, University of Wisconsin, Milwaukee (872-57-50)

4:10 p.m. (54) *A space version of the Bass-Heller-Swan formula.*
Bruce Hughes* and **Stratos Prassidis**, Vanderbilt University (872-57-40)

4:40 p.m. (55) *Topological characterizations of iterated function systems of $[0,1]$ and covering maps of the 1-sphere.*
P. F. Duvall, University of North Carolina, Greensboro, and **L. S. Husch***, University of Tennessee, Knoxville (872-54-27)

General Session

2:10 p.m.–5:35 p.m. Mason, Bryant Conference Center

2:10 p.m. (56) *The symmetric genus of K-metacyclic groups.*
Coy L. May and **Jay Zimmerman***, Towson State University (872-20-137)

2:25 p.m. (57) *Fair cost allocation on a parallel processor.*
David C. Fisher*, **Daniel C. Burnett** and **Patricia D. Jungers**, University of Colorado, Denver (872-20-30)

2:40 p.m. (58) *An equivalence theorem for finite abelian groups.* Preliminary report.
Paul Hill, Auburn University, Auburn (872-20-78)

2:55 p.m. (59) *Subsocles supporting isotype and balanced subgroups.*
Paul Hill, Auburn University, Auburn, and **Charles Megibben***, Vanderbilt University (872-20-93) (Sponsored by Glenn F. Webb)

3:10 p.m. (60) *Division space axiomatics.* Preliminary report.
Krzysztof Ostaszewski, University of Louisville (872-28-02)

3:25 p.m. (61) *On weakly mixing tranformations and weakly wandering partitions.*
Karin Reinhold-Larsson* and **Andres del Junco**, University of Toronto (872-28-121)

3:40 p.m. (62) *On existence of solutions for systems of functional differential equations with singular coefficient matrices.*
Josaphat A. Uvah, University of West Florida (872-34-114)

3:55 p.m. (63) *Multiplier transformations on Hardy spaces.* Preliminary report.
Dashan Fan, University of Wisconsin, Milwaukee (872-42-32) (Sponsored by Tzu-Chu Lin)

Friday, March 13 (cont'd)

4:10 p.m. (64) *K-theory for certain reduced free products of C^*-algebras.*
Kevin McClanahan, University of Mississippi (872-47-53)

4:25 p.m. (65) *On star with Lindelöf center property.* Preliminary report.
G. R. Hiremath, Talladega College (872-54-71)

4:40 p.m. (66) *Limiting notions of the IP type in the enveloping semigroup.*
Kamel N. Haddad, University of Maryland, College Park (872-54-74)

4:55 p.m. (67) *Enhanced cohomology groups and obstruction theory.*
Marek A. Galecki, University of Tennessee, Knoxville (872-55-42)

5:10 p.m. (68) *A singularly perturbed stochastic delay system with a small parameter.*
K. M. Ramachandran, University of South Florida (872-60-34)

5:25 p.m. (69) *Bivariate extreme value distributions.* Preliminary report.
Maged Elshamy, University of Alabama, Huntsville (872-62-98)

Invited Address

11:00 p.m.–noon Rasta-A, Bryant Conference Center

(70) *Invariant measures for noninvertible maps.* Preliminary report.
Jane M. Hawkins, University of North Carolina, Chapel Hill (872-28-75)

Saturday, March 14

Special Session on Spectral Theory of Ordinary and Partial Differential Operators, II

9:00 a.m.–10:50 a.m. Thames, Bryant Conference Center

9:00 a.m. (71) *On the completeness of wave operators under loss of local compactness.*
Rainer Hempel*, University of Munich, Germany, and **Ricardo Weder**, University of Mexico (872-35-43)

9:30 a.m. (72) *Absolutely continuous spectra of Sturm-Liouville equations.* Preliminary report.
Don Hinton*, University of Tennessee, Knoxville, and **Stephen Clark**, University of Missouri, Rolla (872-34-48)

10:00 a.m. (73) *Regularity of solutions for singular Schrödinger equations.*
Andreas M. Hinz, University Munchen, Germany (872-35-17) (Sponsored by Richard C. Brown)

10:30 a.m. (74) *Symmetry results for positive solutions of reaction-diffusion equations.*
Hans G. Kaper*, **Man Kam Kwong** and **Yi Li**, Argonne National Laboratory (872-35-117)

Special Session on Infintite groups and group rings, III

9:00 a.m.–10:50 a.m. Mobile, Bryant Conference Center

9:00 a.m. (75) *Endomorphisms of negatively curved triangles of groups.* Preliminary report.
John Meier, Cornell University (872-20-85)

9:30 a.m. (76) *The automorphism group of a virtual direct product of groups.*
Martin R. Pettet, University of Toledo (872-20-46)

10:00 a.m. (77) *Locally solvable finitary linear groups.*
Richard E. Phillips, Michigan State University (872-20-01)

10:30 a.m. (78) *A characterization of infinite polynilpotent groups.*
Akbar Rhemtulla*, University of Alberta, and **Howard Smith**, Bucknell University (872-20-90)

Special Session on Combinatorial Problems on Partially Ordered Sets, III

9:00 a.m.–10:50 a.m. Central, Bryant Conference Center

9:00 a.m. (79) *Angle orders.* Preliminary report.
Robert E. Jamison, Clemson University (872-06-108) (Sponsored by William H. Ruckle)

9:30 a.m. (80) *Entropy and sorting.*
Jeff Kahn and **Jeong Han Kim***, Rutgers University, New Brunswick (872-06-96)

10:00 a.m. (81) *About the partition relation on infinite posets.*
Gregory McColm, University of South Florida (872-04-62)

10:30 a.m. (82) *The word problem in slim varieties.*
John Pedersen, University of South Florida (872-08-106)

Special Session on Operator Algebras, III

9:00 a.m.–10:50 a.m. Rasta-A, Bryant Conference Center

9:00 a.m. (83) *Structured-embedding TAF algebras.* Preliminary report.
David R. Larson*, Texas A & M University, College Station, and **Alan Hopenwasser**, University of Alabama (872-46-63)

9:30 a.m. (84) *On radicals of triangular operator algebras.*
Laura Mastrangelo, University of Puerto Rico, Puerto Rico (872-47-20)

10:00 a.m. (85) *An operator algebra approach to the Fourier transform on the torus.*
Richard Mercer, Wright State University (872-47-97)

10:30 a.m. (86) *Some problems and new results in nonselfadjoint operator algebras.*
John L. Orr, University of Nebraska, Lincoln (872-47-125)

Special Session on Geometric Topology, III

9:00 a.m.–10:50 a.m. Birmingham, Bryant Conference Center

9:00 a.m. (87) *The Nielsen number as an isotopy invariant.*
Michael Kelly, University of Idaho (872-57-11)

9:30 a.m. (88) *Nonsmoothable locally linear actions on a contractible 4-manifold.*
Slawomir Kwasik and **Terry Lawson***, Tulane University (872-57-24)

10:00 a.m. (89) *Signature invariants.*
Jerome Levine, Brandeis University (872-57-92)

10:30 a.m. (90) *A formula for the equivariant topological torsion of a fiber homotopy equivalence.*
Stratos Prassidis, Vanderbilt University (872-57-41)

Special Session on Harmonic Analysis and Related Topics, II

9:00 a.m.–10:50 a.m. Mason, Bryant Conference Center

9:00 a.m. (91) *Operators on the weighted special atom spaces.*
Geraldo De Souza, Auburn University, Auburn (872-42-52) (Sponsored by Georg Hetzer)

9:30 a.m. (92) *Cauchy integral and analytic capacity.*
X. Fang, Washington University (872-42-49) (Sponsored by Quoshin Chi)

10:00 a.m. (93) *Interpolation between weighted Hardy spaces.*
Michael Cwikel, Technion-Israel Institute of Technology, Israel, **John E. McCarthy***, Washington University, and **Thomas H. Wolff**, California Institute of Technology (872-46-26)

10:30 a.m. (94) *Multipliers with natural local spectrum and applications to convolution operators.*
Michael M. Neumann, Mississippi State University (872-43-21)

Special Session on Approximation Theory: Modern Methods, II

9:00 a.m.–10:50 a.m. Logan, Bryant Conference Center

9:00 a.m. (95) *Quasiconformality of complex planar spline interpolants.* Preliminary report.
H. P. Dikshit, R. D. University India, **Bernd Lange*** and **R. A. Zalik**, Auburn University, Auburn (872-41-131)

9:30 a.m. (96) *On inner approximation-solvability of nonlinear equations.*
Ram N. Mohapatra, University of Central Florida (872-41-55)

10:00 a.m. (97) *Convergence of Newtonlike methods for singular operator equations using outer inverses.*
M. Zuhair Nashed, University of Delaware (872-65-130)

10:30 a.m. (98) *Spectral extrapolation and limited angle tomography.* Preliminary report.
Timothy Edward Olson, Dartmouth College (872-41-129)

Invited Address

11:00 a.m.–noon Rasta-A, Bryant Conference Center

(99) *What is elliptic cohomology?*
Serge Ochanine, University of Kentucky (872-99-139)

Invited Address

1:00 p.m.–2:00 p.m. Rasta-A, Bryant Conference Center

(100) *Pyramid schemes for the recursive computation of multivariate polynomials.*
Charles A. Micchelli, IBM T. J. Watson Research Center, Yorktown Heights, New York (872-99-140)

Special Session on Spectral Theory of Ordinary and Partial Differential Operators, III

2:10 p.m.–6:00 p.m. Thames, Bryant Conference Center

2:10 p.m. (101) *Weighted Friedrichs inequalities in amalgams.*
Hans Heinig*, McMaster University, and **Alois Kufner**, Czechoslovakia Akademy of Sciences, Czechoslovakia (872-26-18)

2:40 p.m. (102) *Multiplicity results for nonlinear Dirichlet problems.*
Man Kam Kwong, Argonne National Laboratory (872-34-115)

3:10 p.m. (103) *Stability analysis of positive solutions to semipositone problems.*
Ratnasingham Shivaji, Mississippi State University (872-35-94) (Sponsored by Richard C. Brown)

3:40 p.m. (104) *Approximation of isolated eigenvalues of ordinary differential operators.*
Gunter Stolz*, University of California, Los Angeles, and **Joachim Weidmann**, J. W. Goethe-Universitat, Germany (872-34-59)

4:10 p.m. (105) *A proof of a logarithmic Sobolev inequality.* Preliminary report.
Giorgio Talenti, University of Florence, Italy (872-46-88)

4:40 p.m. (106) *A general approach to the polynomial solutions of differential equations.*
A. Turbiner, University de Luminy, France (872-34-119) (Sponsored by Richard C. Brown)

5:10 p.m. (107) *Discrete inequalities, orthogonal polynomials and the spectral theory of difference operator.*
W. D. Evans, University of Wales College of Cardiff, United Kingdom (872-35-134) (Sponsored by Richard C. Brown)

Saturday, March 14 (cont'd)

5:40 p.m. (108) *Numerical estimation of the Titchmarsh-Weylm-function.*
B. M. Brown, University of Wales, United Kingdom (872-35-136) (Sponsored by Richard C. Brown)

Special Session on Infintite groups and group rings, IV

2:10 p.m.–3:30 p.m. Mobile, Bryant Conference Center

2:10 p.m. (109) *Factorizations by Abelian subgroups.*
Derek J. S. Robinson*, University of Illinois, Urbana-Champaign, and **E. Stonehewer**, University of Warwick, England (872-20-23)

2:40 p.m. (110) *Maximal subgroups of infinite symmetric groups.*
Simon Thomas, Rutgers University, New Brunswick (872-20-67) (Sponsored by James D. Sharp)

3:10 p.m. (111) *Direct factor theorems for commutative group algebras.*
William Ullery, Auburn University, Auburn (872-20-10)

Special Session on Ergodic Theory and Dynamical Systems, II

2:10 p.m.–5:00 p.m. Central, Bryant Conference Center

2:10 p.m. (112) *Nonsingular K-automorphisms and exact endomorphisms.* Preliminary report.
C. E. Silva, Williams College (872-28-111)

2:40 p.m. (113) *Entropy of snakes and a restricted variational principle.*
Michal Misiurewicz, University of Warsaw, Poland and Princeton University, and **Juan Tolosa***, Stockton State College (872-58-104)

3:10 p.m. (114) *Random samplings of flows.*
Mate Wierdl, University of North Carolina, Chapel Hill (872-28-109) (Sponsored by Jane M. Hawkins)

3:40 p.m. (115) *Dimension group constraints for factors of sofic shifts.*
Susan Williams, University of South Alabama (872-54-105)

4:10 p.m. (116) *Generic results for cocycles in a semidirect product.*
Karma Dajani, University of South Alabama (872-28-44)

4:40 p.m. (117) *Asymptotic measures.* Preliminary report.
Donna Molinek, University of North Carolina, Chapel Hill (872-58-138)

Special Session on Operator Algebras, IV

2:10 p.m.–5:00 p.m. Rasta-A, Bryant Conference Center

2:10 p.m. (118) *A fixed-point theorem for amenable C^*-algebras.*
Alan Paterson, University of Mississippi (872-46-14)

2:40 p.m. (119) *Certain representations of TAF algebras.*
Justin R. Peters, Iowa State University (872-46-68)

3:10 p.m. (120) *Some examples and problems concerning stability of commutative subspace lattices.*
David R. Pitts, University of Nebraska, Lincoln (872-47-126)

3:40 p.m. (121) *Ideal structure in the Haagerup tensor product of C^*-algebras.*
Steven Allen, **Allan Sinclair**, University of Edinburgh, Scotland, and **Roger Smith***, Texas A&M University, College Station (872-46-72)

4:10 p.m. (122) *Reflexive subalgebras of AF algebras.*
Justin R. Peters, Iowa State University, and **Warren R. Wogen***, University of North Carolina, Chapel Hill (872-46-25)

4:40 p.m. (123) *Homotopy groups of the unitary groups and the Grassmann spaces of certain C^*-algebras.*
Shuang Zhang, University of Cincinnati (872-46-107)

Special Session on Geometric Topology, IV

2:10 p.m.–5:00 p.m. Birmingham, Bryant Conference Center

2:10 p.m. (124) *Universal compacta for dimension theories.*
Leonard R. Rubin, University of Oklahoma (872-54-38)

2:40 p.m. (125) *Augmented group systems and n-knots.*
Daniel S. Silver, University of South Alabama (872-57-70)

3:10 p.m. (126) *Cell-like images and UV^m groups.*
Gerard A. Venema, Calvin College (872-57-15)

3:40 p.m. (127) *Some extension properties of homeomorphism groups of compact surfaces.* Preliminary report.
James E. West, Cornell University (872-57-128)

4:10 p.m. (128) *Locally flat surfaces in the complex projective plane.* Preliminary report.
Ronnie Lee, Yale University, and **Dariusz M. Wilczynski***, University of Notre Dame (872-57-127)

4:40 p.m. (129) *Supersignature and the unknotting number.*
Józef H. Przytycki*, University of California, Riverside, and **Pawel Traczyk**, University of Warszawski, Poland (872-57-135)

Special Session on Harmonic Analysis and Related Topics, III

2:10 p.m.–5:00 p.m. Mason, Bryant Conference Center

2:10 p.m. (130) *Weighted norm inequalities for singular integral operators.*
Carlos Perez, University of Kentucky (872-42-33)

2:40 p.m. (131) *Size estimates for eigenvectors of singular integral operators.*
Richard Rochberg, Washington University (872-47-99)

3:10 p.m. (132) *Non-convolution transforms with oscillating kernels that map $\dot{B}_1^{0,1}$ into itself.*
Gary Sampson, Auburn University, Auburn (872-42-05)

3:40 p.m. (133) *Elliptic-caloric measures.*
Caroline Sweezy, New Mexico State University (872-35-102)

4:10 p.m. (134) *Eigenvalue estimates for degenerate fourth-order operators.* Preliminary report.
J. Michael Wilson, University of Vermont (872-42-35) (Sponsored by Tavan T. Trent)

4:40 p.m. (135) *Cyclic cocycles on some nilpotent analytic group and trace formula for some perturbation of partial differential operator.* Preliminary report.
Daoxing Xia, Vanderbilt University (872-47-31)

Special Session on Approximation Theory: Modern Methods, III

2:10 p.m.–4:30 p.m. Logan, Bryant Conference Center

2:10 p.m. (136) *Hermite interpolation on the lattice* $\mathbf{Z}^d$.
K. Jetter, University of Duisburg, Germany, **Sherman D. Riemenschneider**, University of Alberta, and **Z. Shen***, University of Wisconsin, Madison (872-41-101)

2:40 p.m. (137) *Uniform approximation by continuous isotone functions in a normed vector lattice.*
Vasant A. Ubhaya, North Dakota State University (872-41-64)

3:10 p.m. (138) *Variable knot splines and numerical quadratures for singular integrals.* Preliminary report.
Yuesheng Xu, North Dakota State University (872-65-65) (Sponsored by Vasant A. Ubhaya)

3:40 p.m. (139) *Best uniform approximation by harmonic functions on subsets of Riemann surfaces.* Preliminary report.
D. Zwick*, University of Vermont, and **P. M. Gauthier**, University of Montreal (872-41-56)

4:10 p.m. (140) *Quasiconformality and quasiregularity of Wachspress type rational complex planar splines of higher degree.*
H. P. Dikshit, **A. Ojha**, R. D. University, India, and **R. A. Zalik***, Auburn University, Auburn (872-41-84)

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Announcing the schedule for the 1992 CBMS Regional Research Conferences (pending NSF funding). Submit your proposals for the 1993 Conference Series before April 1, 1992. See the News and Announcements section of this issue for more information.

Turbulance of Non-Linear Waves with Applications to Geophysics and Oceanography
Vladimir Zakharov, lecturer
May 25–29 at Case Western Reserve University

Hamiltonian Graphs
Roland Häggkvist, lecturer
May 26–30 at the University of Louisville

New Function Spaces and Geometric Analysis in Several Complex Variables
Steven G. Krantz, lecturer
May 26–31 at George Mason University

Number Theory and Dynamical Systems
Jeffery C. Lagarias, lecturer
June 1–5 at California State University at Fresno

Uncertain Reasoning
Glenn Shafer, lecturer
June 1–5 at the University of North Dakota at Grand Forks

Hopf Algebras and Their Actions on Rings
Susan Montgomery, lecturer
August 11–15 at DePaul University

Springfield, Missouri
Southwest Missouri State University
March 20–21, 1992

Program

The eight-hundred-and-seventy-third meeting of the American Mathematical Society (AMS) will be held at the Southwest Missouri State University (SMSU) on Friday, March 20, and Saturday, March 21, 1992. All sessions and addresses will be held in Glass Hall (John Q. Hammons Parkway).

Invited Addresses

By invitation of the Central Section Program Committee, there will be four invited one-hour addresses. The speakers, their affiliations, and the titles of their talks where available are:

Alexander Eremenko, Institute of Low Temperature Physics and Engineering, *Recent progress in value distribution theory.*

Julia Knight, University of Notre Dame, *Algorithms based on guessing: Infinitely nested priority arguments.*

Peter J. Olver, University of Minnesota, *Quantization of Lie algebra cohomology and quasi-exactly solvable Schrodinger operators.*

Ernst A. Ruh, Ohio State University, *Nilpotent structures on principal bundles.*

Special Sessions

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

Harmonic analysis, **Nakhle Habib Asmar** and **Stephen John Montgomery-Smith**, University of Missouri, Columbia.

Combinatorics and discrete geometry, **Margaret M. Bayer**, University of Kansas, Lawrence.

Partial differential equations, **Wenxiong Chen** and **Shou Chuan Hu**, Southwest Missouri State University.

Commutative algebra, **William J. Heinzer** and **Craig Huneke**, Purdue University, and **Kishor M. Shah**, Southwest Missouri State University.

The geometry of connections, **Louis Hernandez**, University of Chicago, and **Ernst A. Ruh**.

Lie algebras, cohomology, and new applications to quantum mechanics, **Niky Kamran**, McGill University, and **Peter J. Olver**.

C-algebras and algebraic topology*, **Ellen Maycock Parker**, DePauw University.

Semigroups, **Boris M. Schein**, University of Arkansas.

Fourier analysis, **Vera B. Stanojevic**, Southwest Missouri State University.

Approximation theory, **Xingping Sun** and **Xiang Min Yu**, Southwest Missouri State University.

Geometry of affine space, **David Wright**, Washington University.

Classical complex analysis and related areas, **Jang-Mei Wu**, University of Illinois, Urbana, and **David Drasin**, Purdue University.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Late papers will not be accommodated.

Registration

The meeting registration desk will be located in the eastern foyer of the second floor of Glass Hall. The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians.

Accommodations

Rooms have been blocked for participants at the University Plaza Hotel, the Quality Inn North Motel, and the Park Inn Motel. Participants should make their own arrangements directly with the hotel of their choice and ask for the special AMS meeting rate. Other motels close to the Quality Inn are: Best Inns (417-866-6766), Best Western (417-862-0701), Econo Lodge (417-864-3565), Holiday Inn North (417-865-8600), Markham Inn (417-866-3581), Motel 6 (417-869-4343), Ramada Inn (417-831-3131), Red Roof Inns (417-831-2100), Scottish Inns (417-865-6565), and Super 8 Motel (417-833-9218). Rates are subject to a room tax. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

Holiday Inn - University Plaza Hotel (one block from campus)

333 John Q. Hammons Parkway Springfield, MO 65806
Telephone: 417-864-7333

Flat rate: $62.50

Park Inn International (2 miles from campus)
1772 South Glenstone Avenue, Springfield, MO 65806
Telephone: 417-882-1113

Flat rate: $43

Quality Inn North (5 miles from campus)
I-44 at Exit 80-B, Springfield, MO 65806
Telephone: 417-833-3108

Flat rate: $45

Food Service

The Bears' Den has a salad bar, serves sandwiches, pizza, and a limited variety of other hot foods. It is located in the basement of the Campus Union. It will be open for lunch on Friday and Saturday. A complete list of local restaurants will be available at the meeting registration desk.

Parking

Free parking will be available to participants in a large lot on the south side of Glass Hall. Permits will not be required, as the university will be on spring break.

Travel

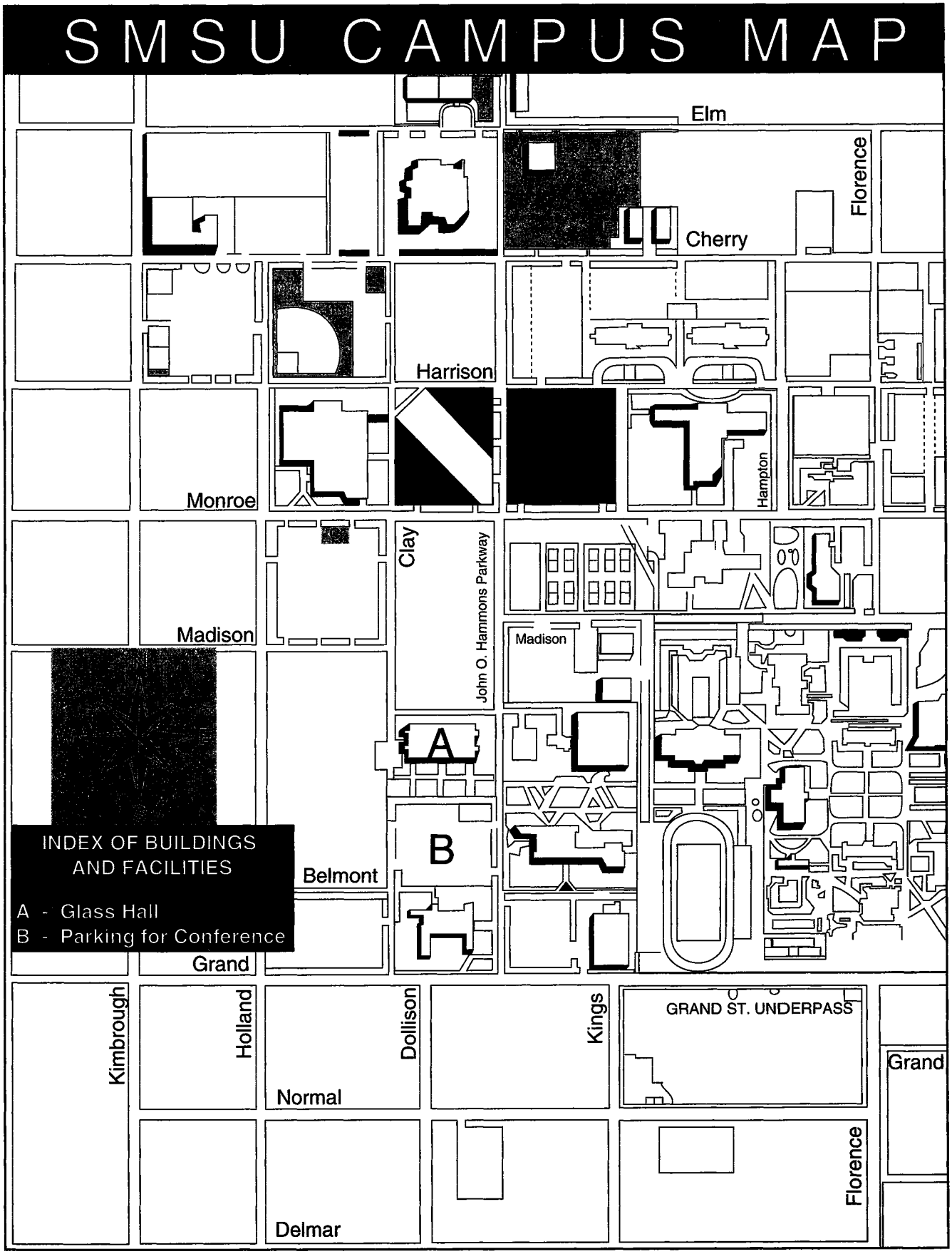
Arriving by air: Springfield Regional Airport is serviced by American Eagle, Northwest Airlink, TWA, USAir, and United Airlines. The airport is serviced by Avis, Budget, Hertz, and National car rental agencies. Transportation from the airport to the Park Plaza Hotel or the Quality Inn can be accomplished by hotel courtesy van. Transportation to other motels can be accomplished by taxi; relevant phone numbers are: Springfield City Cab 865-5787 and Yellow Cab Co. 862-5511. Participants renting a car at the airport may reach the university (and the Holiday Inn - University Plaza Hotel), by traveling east on Kearney Avenue (the only exit from the airport), then traveling south on National Avenue for about four miles. The other motels can be reached by turning from Kearney onto I-44, heading east.

Arriving by car: Springfield is located on I-44, roughly halfway between Oklahoma City and St. Louis on U.S. 65, which runs north and south, and on U.S. 60. Those arriving by car on I-44 should turn off at Exit 80 (Glenstone Avenue, also known as U.S. 65 Bus., where numerous motels, including the Quality Inn, are located. The Park Inn is located five miles south on Glenstone. To reach Glass Hall or the University Plaza Hotel, proceed south on Glenstone Avenue for four miles to Grand Avenue. Proceed west on Grand Avenue for one mile, continue past the corner of the campus at National Avenue, then turn right onto John Q. Hammons Parkway.

Those arriving from the south on U.S. 65 should turn west onto U.S. 60 at the point where these two roads intersect southeast of Springfield. About one mile after this interchange, Glenstone Avenue (U.S. 65 Business) branches off heading north. This is also relevant to anyone coming in from the east on U.S. 60. Those arriving from the southwest on U.S. 60 will find that it becomes Sunshine Avenue, which eventually crosses National Avenue and then Glenstone Avenue.

Weather and Local Information

The average high temperature in Springfield in March is 55°F and the average low is 32°F. Springfield is the hub of the Ozarks region, a scenic area of hills, forests, rivers, lakes, and limestone caverns. Spring is especially lovely, with the redbuds and dogwoods in bloom. Fans of country music may be interested in attending shows in Branson (about 40 miles south of Springfield), which has lately begun to attract some of the top entertainers in the field; those interested should contact the Branson Chamber of Commerce (417-334-4137) to find out who will be performing at the time of the meeting and to get phone numbers for reservations.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Program of the Sessions

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

Abstracts of papers presented in the sessions at this meeting will be found in the March 1992 issue of *Abstracts of papers presented to the American Mathematical Society*, ordered according to the numbers in parentheses following the listings below.

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

Friday, March 20

Special Session on C*-Algebras and Algebraic Topology, I

8:00 a.m.–10:50 a.m. Room 344, Glass Hall

8:00 a.m. (1) *Exotic index theory and the Baum-Connes conjecture for foliations.*
Steven Hurder, University of Illinois, Chicago (873-46-45)

8:30 a.m. (2) *Homotopy invariants for operator algebras.*
Marius Dadarlat, University of Maryland, College Park (873-46-46)

9:00 a.m. (3) *Bilinear forms in equivariant K-theory.*
Claude Schochet, University of Maryland, College Park (873-19-37)

9:30 a.m. (4) *K theory for p-adic algebraic groups.*
Paul Baum, Pennsylvania State University, University Park (873-19-30)

10:00 a.m. (5) *Operator K-theory and representations of p-adic groups.* Preliminary report.
Roger Plymen, University of Manchester, England (873-19-26)

10:30 a.m. (6) *Index theory on buildings.* Preliminary report.
Nigel Higson, Pennsylvania State University, University Park (873-19-169)

Special Session on Partial Differential Equations, I

8:30 a.m.–10:50 a.m. Room 227, Glass Hall

8:30 a.m. (7) *Inertial manifolds and almost-periodic reaction-diffusion equations.*
Pierre A. Vuillermot, University of Texas, Arlington (873-35-127)

9:00 a.m. (8) *Quenching for degenerate semilinear parabolic equations.*
C. Y. Chan* and **P. K. Kong**, University of Southwestern Louisiana (873-35-159)

9:30 a.m. (9) *Singular solutions of the conformal Scalar curvature equation.* Preliminary report.
Robert C. McOwen, Northeastern University (873-35-126)

10:00 a.m. (10) *A characterization of criticality for the Schödinger operator.*
Z. Zhao, University of Missouri, Columbia (873-13-133)

10:30 a.m. Informal Discussion

Special Session on Harmonic Analysis, I

9:00 a.m.–10:50 a.m. Room 262, Glass Hall

9:00 a.m. (11) *A comparison theorem on convergence rates of random walks on groups.*
Kenneth A. Ross* and **Daming Xu**, University of Oregon (873-60-25)

9:30 a.m. (12) *On the entropy norm spaces and the Hardy space* $\mathrm{Re}H^1$.
W. Christopher Lang, Mississippi State University (873-42-09)

10:00 a.m. (13) *Brownian motion and thin sets in Vilenkin groups.*
D. J. Grubb, Kansas State University (873-42-54)

10:30 a.m. (14) *Existence of a basis in the "big disk algebra" and in some C_Λ.*
Florence Lancien, Equipe D'analyses, France (873-42-175) (Sponsored by Stephen J. Montgomery-Smith)

Special Session on Combinatorics and Discrete Geometry, I

9:00 a.m.–10:50 a.m. Room 230, Glass Hall

9:00 a.m. (15) *Relations of various conjectures on latin squares and straightening coefficients.*
Rosa Q. Huang, University of Michigan, Ann Arbor (873-05-131)

9:30 a.m. (16) *Convexity conjectures concerning Gaussian coefficients.*
Kathy M. O'Hara*, University of Iowa, and **Dennis Stanton**, University of Minnesota, Minneapolis (873-05-182)

10:00 a.m. (17) *Characteristic polynomials of hyperplane arrangements interpolating between root systems.* Preliminary report.
Tadeusz Józefiak and **Bruce E. Sagan***, Michigan State University (873-51-21)

10:30 a.m. (18) *Connections between fundamental bases of the homology of the partition lattice and the free Lie algebra.* Preliminary report.
Sheila Sundaram and **Michelle L. Wachs***, University of Miami (873-05-183)

Special Session on Commutative Algebra, I

9:00 a.m.–10:50 a.m. Room 343, Glass Hall

9:00 a.m. (19) *Hilbert rings arising as pullbacks.*
David F. Anderson*, **David E. Dobbs**, University of Tennessee, Knoxville, and **Marco Fontana**, Universita di Roma, Italy (873-13-32)

9:30 a.m. (20) *Catenarity of formal power series rings over a pullback.*
David F. Anderson, **David E. Dobbs***, University of Tennessee, Knoxville, **Marco Fontana**, Universita di Roma, Italy, and **Mohammed Khalis**, University of Lyon I, France (873-13-36)

10:00 a.m. (21) *The existence of flat covers.*
Richard G. Belshoff*, Southwest Missouri State University, **Edgar E. Enochs** and **Jinzhong Xu**, University of Kentucky (873-13-27)

10:30 a.m. (22) *Asymptotic primes and asymptotic grade for modules.* Preliminary report.
Daniel Katz, University of Kansas (873-13-162)
(Sponsored by Satyagopol Mandal)

Special Session on The Geometry of Connections, I

9:00 a.m.–10:50 a.m. Room 342, Glass Hall

9:00 a.m. (23) *The structure of the cut-locus of the boundary for Riemannian surfaces with bounded inradius.*
Stephanie B. Alexander and **Richard L. Bishop***, University of Illinois, Urbana-Champaign (873-53-105)

9:30 a.m. (24) *The geometry of connections.*
James Carlson, University of Utah (873-58-207)

10:00 a.m. (25) *Particle geometry and quantum electrodynamics.*
Andrzej Derdzinski, Ohio State University, Columbus (873-81-120)

Special Session on Classical Complex Analysis and Related Areas, I

9:00 a.m.–10:50 a.m. Room 340, Glass Hall

9:00 a.m. (26) *Some cases of the Sheil-Small conjecture.* Preliminary report.
W. H. J. Fuchs, Cornell University (873-30-190)

9:30 a.m. (27) *Value distribution properties for meromorphic functions in the disk.* Preliminary report.
Linda R. Sons, Northern Illinois University (873-30-167)

10:00 a.m. (28) *Level sets of Bloch functions.*
Steffen Rohde, University of Michigan, Ann Arbor (873-30-178) (Sponsored by Jang-Mei Wu)

10:30 a.m. (29) *On Julia sets of polynomials.*
A. Hinkkanen, University of Illinois, Urbana-Champaign (873-30-172)

Special Session on Lie Algebras, Cohomology, and New Applications to Quantum Mechanics, I

9:00 a.m.–10:50 a.m. Room 237, Glass Hall

9:00 a.m. (30) *Algebraic theory.*
Francesco Iachello, Yale University (873-81-148)
(Sponsored by Peter J. Olver)

9:30 a.m. (31) *On the algebra of tensor operators for $SU(n)$.*
L. C. Biedenharn, Duke University (873-20-160)

10:00 a.m. Informal Discussion

10:30 a.m. (32) *Lie algebras, quantization, and deformations.*
Palle E. T. Jorgensen, University of Iowa (873-81-03)

Special Session on Semigroups, I

9:00 a.m.–10:50 a.m. Room 345, Glass Hall

9:00 a.m. (33) *Syntactic semigroups of codes.*
H. Jürgensen, University of Western Ontario (873-20-225)

9:30 a.m. (34) *Dense recognizable languages.*
M. Ito* and **M. Katsura**, Kyoto Sangyo University, Japan (873-05-33) (Sponsored by Boris M. Schein)

10:00 a.m. (35) *Inverse semigroup theoretic algorithms for properties of finitely generated subgroups of free groups.*
Pascal Weil, University of Paris, France, **Stuart W. Margolis***, **John Meakin** and **Robert Ruyle**, University of Nebraska, Lincoln (873-20-19)

10:30 a.m. (36) *On the fundamental group of a Lie semigroup.*
Karl-Hermann Neeb, Technological Hochschule, Germany (873-20-53)

Special Session on Fourier Analysis, I

9:00 a.m.–10:50 a.m. Room 350, Glass Hall

9:00 a.m. (37) *Measure algebras with polynomial characters.*
William C. Connett* and **Alan L. Schwartz**, University of Missouri, St. Louis (873-33-226)

9:30 a.m. (38) *Supports and localization of multiple Fourier series.*
John F. Price, Maharishi International University (873-42-42)

10:00 a.m. (39) *Characterizations of convergence and Fourier character classes of trigonometric transforms.*
David E. Grow* and **Časlav V. Stanojević**, University of Missouri, Rolla (873-42-151)

10:30 a.m. (40) *Harmonic analysis on semisimple Lie groups.* Preliminary report.
Rebecca A. Herb, University of Maryland, College Park (873-42-152)

Friday, March 20 (cont'd)

Special Session on Approximation Theory, I

9:00 a.m.–10:30 a.m. Room 226, Glass Hall

9:00 a.m. (41) *Shift invariant spaces and approximation.* **Carl de Boor**, University of Wisconsin, Madison, **Ronald A. DeVore***, University of South Carolina, Columbia, and **Amos Ron**, University of Wisconsin, Madison (873-41-231)

9:30 a.m. (42) *Wavelet decomposition and shift-variant spaces.* Preliminary report. **George Kyriazis**, University of South Carolina, Columbia (873-41-230)

10:00 a.m. (43) *The rate of L_p-approximation of certain projection operators.* Preliminary report. **Junjiang Lei**, Oklahoma State University (873-41-163)

10:30 a.m. (44) *On the magnitude of Fourier coefficients.* **Donald J. Newman**, Temple University, and **Oved Shisha***, University of Rhode Island (873-42-212)

Special Session on Geometry of Affine Space, I

9:00 a.m.–10:50 a.m. Room 346, Glass Hall

9:00 a.m. Informal Discussion

9:30 a.m. (45) *Unipotent actions on affine space.* **Dennis M. Snow**, University of Notre Dame (873-14-72)

10:00 a.m. (46) *Chain rule for multivariable resultants.* **Charles Ching-An Cheng**, **James H. McKay** and **Stuart Sui-Sheng Wang***, Oakland University (873-13-109)

10:30 a.m. Informal Discussion

Session on Algebra

9:00 a.m.–10:50 a.m. Room 347, Glass Hall

9:00 a.m. (47) *Unitary amicable pairs to 10^8.* **Rudolph M. Najar**, California State University, Fresno (873-11-192)

9:20 a.m. (48) *On the index of Cohen-Macaulay local rings.* **S. Ding**, Texas Technical University (873-13-16)

9:40 a.m. (49) *On the conjugacy problem for one-relator monoids with finite order elements.* **Louxin Zhang**, University of Waterloo (873-20-114)

10:00 a.m. (50) *Some remarks on filtrations and plethysms.* **Mihalis Maliakas**, University of Arkansas, Fayetteville (873-20-144)

10:20 a.m. (51) *Locally distributive rings.* Preliminary report. **Mary H. Wright**, Southern Illinois University (873-16-149)

10:40 a.m. (52) *Unitary $**$amicable integers.* Preliminary report. **Dale Woods**, University of Central Oklahoma (873-11-143)

Invited Address

11:00 a.m.–11:50 a.m. Hutchens Auditorium, Glass Hall

(53) *Quantization of Lie algebras cohomology and quasi-exactly solvable Schrödinger operators.* **Peter J. Olver**, University of Minnesota, Minneapolis (873-22-01)

Invited Address

1:30 p.m.–2:20 p.m. Hutchens Auditorium, Glass Hall

(54) *Nilpotent structures on principal bundles.* **Ernst A. Ruh**, Ohio State University, Columbus (873-53-80)

Special Session on Harmonic Analysis, II

3:00 p.m.–5:50 p.m. Room 262, Glass Hall

3:00 p.m. (55) *Sidon sets and quasi-Banach spaces.* **Nigel Kalton**, University of Missouri, Columbia (873-43-89)

3:30 p.m. (56) *Symmetry conditions and operators on Triebel-Lizorkin spaces.* Preliminary report. **James E. Daly**, University of Colorado, Colorado Springs (873-43-07)

4:00 p.m. (57) *A radial phi-transform for radial functions.* Preliminary report. **Michael Frazier**, Michigan State University (873-41-166)

4:30 p.m. (58) *Bounding zeros of H^p functions via concentrations.* **Maria Girardi**, University of South Carolina, Columbia (873-30-11)

5:00 p.m. (59) *Non-convolution transforms with oscillating kernels that map $\dot{B}_1^{0,1}$ into itself.* **Gary Sampson**, Auburn University, Auburn (873-42-02)

5:30 p.m. (60) *The role of hyperfinite sets in analysis.* Preliminary report. **Nader Vakil**, Western Illinois University (873-42-238)

Special Session on Combinatorics and Discrete Geometry, II

3:00 p.m.–5:50 p.m. Room 230, Glass Hall

3:00 p.m. (61) *An algebraic characterization of planar graphs.* **Dan Archdeacon***, University of Vermont, **C. H. C. Little**, Massey University, New Zealand, and **P. Bonnington**, University of Waikato, New Zealand (873-05-83)

3:30 p.m. (62) *On Hamilton cycles in connected vertex transitive graphs.* **Henry H. Glover**, Ohio State University, Columbus (873-05-220)

4:00 p.m. (63) *Functions that bound the number of edges in a graph.* **Ruth Haas*** and **Michael O. Albertson**, Smith College (873-05-112)

4:30 p.m. *Embedding graphs in disjunctive products of lines.* (64) Preliminary report.
Robert E. Jamison*, Clemson University, and **Selma Strahringer**, Technological Hochschule Darmstadt, Germany (873-52-221) (Sponsored by William H. Ruckle)

5:00 p.m. *Pseudospherical crossing numbers.* (65) **Jim Lawrence**, George Mason University (873-05-124)

5:30 p.m. *On the average genus of graphs.* Preliminary report. (66) **Saul Stahl**, University of Kansas (873-05-43)

Special Session on Partial Differential Equations, II

3:00 p.m.–6:50 p.m. Room 227, Glass Hall

3:00 p.m. *Hyperbolic systems of conservation laws with umbilic points.* Preliminary report. (67) **Gui-Qiang Chen***, University of Chicago, and **Pui Tak Kan**, University of Wisconsin, Madison (873-35-194)

3:30 p.m. Informal Discussion

4:00 p.m. *A priori estimates for solutions to nonlinear elliptic equations.* (68) **Wenxiong Chen**, Southwest Missouri State University, and **Congming Li***, Institute for Advanced Study (873-35-216)

4:30 p.m. *The existence, uniqueness and regularity of nonlinear partial differential systems.* (69) **S. Walter Wei**, University of Oklahoma (873-35-132)

5:00 p.m. *Global solutions of Maxwell's equations in an electromagnetic field with the temperature-dependent electrial conductivity.* (70) **Hong-Ming Yin**, University of Toronto (873-35-04)

5:30 p.m. *Nonstandard finite-difference schemes for PDE's.* (71) **Ronald E. Mickens**, Clark Atlanta University (873-65-108)

6:00 p.m. *An elliptic-parabolic system of degenerate type.* (72) **Xiangsheng Xu**, University of Arkansas, Fayetteville (873-35-101)

6:30 p.m. *Fundamental solutions of subelliptic differential operators.* (73) **Chuan-Yi Xu**, University of Florida (873-35-146)

Special Session on Commutative Algebra, II

3:00 p.m.–5:50 p.m. Room 343, Glass Hall

3:00 p.m. *Hilbert coefficients and local cohomology in dimension 2.* (74) **Judith D. Sally**, Northwestern University (873-13-66)

3:30 p.m. *On graded rings associated to analytic deviation one ideals of small height.* (75) **Sam Huckaba**, Florida State University (873-13-64)

4:00 p.m. *Resolutions of Gorenstein ideals.* (76) **Hema Srinivasan**, University of Missouri, Columbia (873-13-119)

4:30 p.m. *Hilbert functions and Betti numbers.* (77) **E. Graham Evans, Jr**, University of Illinois, Urbana-Champaign (873-13-137)

5:00 p.m. *Passing across linkage.* Preliminary report. (78) **Susan M. Palmer**, Southwest Missouri State University (873-13-102)

5:30 p.m. *Fixed rings of coherent regular rings.* (79) **Sarah Glaz**, University of Connecticut, Storrs (873-13-128)

Special Session on The Geometry of Connections, II

3:00 p.m.–6:50 p.m. Room 342, Glass Hall

3:00 p.m. *Nonabelian Hodge theory and intersection cohomology.* Preliminary report. (80) **Kevin Corlette**, University of Chicago (873-57-110)

3:30 p.m. *Connection preserving actions of lattices in $SL(n, R)$.* (81) **Renato Feres**, University of Chicago (873-58-171)

4:00 p.m. *On the local structure of collapsed manifolds.* (82) Preliminary report.
Patrick Ghanaat, University of Basel, Switzerland (873-53-232)

4:30 p.m. *Rigidity problems for hypersurfaces in complex projective spaces.* (83) **Gary R. Jensen***, Washington University, and **Emilio Musso**, Istituo Matematico, Italy (873-53-74)

5:00 p.m. *Scalar curvature rigidity.* Preliminary report. (84) **Maung Min-oo**, McMaster University (873-53-85)

5:30 p.m. *Metric pinching of locally symmetric spaces.* (85) **Conrad Plaut**, Ohio State University, Columbus (873-58-79)

Special Session on Classical Complex Analysis and Related Areas, II

3:00 p.m.–5:20 p.m. Room 340, Glass Hall

3:00 p.m. *Extremal problems involving logarithmic and Green capacity.* (86) **Richard Laugesen**, Washington University (873-31-106)

3:30 p.m. *The boundary absolute continuity of quasiconformal mappings.* (87) **Juha Heinonen**, University of Michigan, Ann Arbor (873-30-98)

4:00 p.m. *Structural instability of exponential functions.* (88) Preliminary report.
Zhuan Ye, Purdue University, West Lafayette (873-30-210)

4:30 p.m. *Null sets for doubling and dyadic doubling measures.* (89) Preliminary report.
Jang-Mei Wu, University of Illinois, Urbana-Champaign (873-28-107)

5:00 p.m. *Some recent results of potential theory.* (90) **M. Sodin**, Purdue University, West Lafayette (873-31-199) (Sponsored by Jang-Mei Wu)

Special Session on Lie Algebras, Cohomology and New Applications to Quantum Mechanics, II

3:00 p.m.–5:50 p.m. Room 237, Glass Hall

3:00 p.m. *Algebraic approaches to molecular electronic structure.* (91) **Josef Paldus**, University of Waterloo (873-81-228) (Sponsored by Peter J. Olver)

Friday, March 20 (cont'd)

3:30 p.m. Informal Discussion

4:00 p.m. (92) *The Lie algebraic approach to q-series and q-difference equations.*
Willard Miller, Jr.*, University of Minnesota, Minneapolis, and **E. G. Kalnins**, University of Waikato, New Zealand (873-33-198)

4:30 p.m. (93) *Hidden symmetries of differential equations.*
Barbara Abraham-Shrauner, Washington University (873-34-193) (Sponsored by Peter J. Olver)

5:00 p.m. (94) *Coherent tensor operators.* Preliminary report.
Dan Flath, University of South Alabama (873-22-168)

5:30 p.m. (95) *About polynomial solutions of differential equations.*
A. V. Turbiner, University de Luminy, France (873-22-202) (Sponsored by Peter J. Olver)

Special Session on C*-Algebras and Algebraic Topology, II

3:00 p.m.–6:50 p.m. Room 344, Glass Hall

3:00 p.m. (96) *A new approach to Bott periodicity.*
George A. Elliott, **Ryszard Nest**, University of Copenhagen, Denmark, and **Toshikazu Natsume***, State University of New York, Buffalo (873-19-174)

3:30 p.m. (97) *Power maps and Hodge decomposition in Hochschild and cyclic homology.* Preliminary report.
Dan Burghelea, Ohio State University, Columbus (873-46-97)

4:00 p.m. (98) *Operator convolution algebras.*
Edward G. Effros, University of California, Los Angeles, and **Zhong-Jin Ruan***, University of Illinois, Urbana-Champaign (873-46-58)

4:30 p.m. (99) *Topological orbit equivalence.* Preliminary report.
Thierry Giordano, University of Ottawa, **Ian Putnam***, University of Victoria, and **Christian Skau**, University of Trondheim, Norway (873-19-31) (Sponsored by Ellen M. Parker)

5:00 p.m. (100) *Cyclic cocycles, index theory on open manifolds and Novikov conjecture for uniformly contractible spaces.* Preliminary report.
Guoliang Yu, Mathematical Sciences Research Institute, Berkeley (873-58-38)

5:30 p.m. (101) *Hermitian sheaves in operator theory.* Preliminary report.
Keren Yan, Indiana University-Purdue University, Indianapolis (873-47-211)

6:00 p.m. (102) *Quantum Riemann surfaces.*
S. Klimek, Indiana University-Purdue University, Indianapolis (873-81-197) (Sponsored by Ellen M. Parker)

6:30 p.m. (103) *"Adiabatic" cobordism theorem for the analytic torsion and the η-invariant.*
Krzysztof Wojciechowski, Indiana Univ-Purdue University at Indianapolis (873-57-196)

Special Session on Semigroups, II

3:00 p.m.–5:50 p.m. Room 345, Glass Hall

3:00 p.m. (104) *The largest proper ideals of certain transformation semigroups.* Preliminary report.
K. D. Magill, Jr., State University of New York, College at Buffalo (873-20-15)

3:30 p.m. (105) *Endormorphism monoids of generators in categories of acts.*
Ulrich Knauer, University of Oldenburg, Germany (873-20-177) (Sponsored by Boris M. Schein)

4:00 p.m. (106) *S_n-normal semigroups.*
Robert B. McFadden, University of Louisville (873-20-158)

4:30 p.m. (107) *Description of commutative semigroups in terms of their partial automorphisms.*
Boris M. Schein and **Shu Zhang***, University of Arkansas, Fayetteville (873-20-121)

5:00 p.m. (108) *Green's relations on G_X-normal semigroups.*
Inessa Levi, University of Louisville (873-20-12)

5:30 p.m. (109) *Idempotent endomorphisms in finite-dimensional v^*-algebras.*
Andrew Averill, Maharishi International Univeristy (873-20-41)

Special Session on Fourier Analysis, II

3:00 p.m.–5:50 p.m. Room 350, Glass Hall

3:00 p.m. (110) *A characterization and a generalization of continuity.*
J. Marshall Ash, **Jonathan Cohen***, DePaul University, **Christopher Freiling**, California State University, San Bernardino, and **Eric Rieders**, DePaul University (873-26-71)

3:30 p.m. (111) *Orthonormal trigonometric polynomial bases and the theory of wavelets.* Preliminary report.
K. I. Oskolkov, Queen's University (873-42-154) (Sponsored by Vera B. Stanojevic)

4:00 p.m. (112) *Eigenfunction method of solvability of periodic BVP's for semilinear hyperbolic equations.* Preliminary report.
P. S. Milojević, New Jersey Institute of Technology (873-47-153)

4:30 p.m. (113) *Boundedness of maximal operator and some combinatorial estimates.*
Bogdan Baishanski, Ohio State University, Columbus (873-42-217)

5:00 p.m. (114) *New elementary transcendental functions and generalzied trigonometric series.*
Everett McCoy, University of Missouri, Rolla (873-42-241) (Sponsored by Vera B. Stanojevic)

5:30 p.m. Informal Discussion

Special Session on Approximation Theory, II

3:00 p.m.–5:20 p.m. Room 226, Glass Hall

3:00 p.m. (115) *Exponential decay and resolvents of banded infinite matrices.*
Dale T. Smith, Gadsden, Alabama (873-47-155)

3:30 p.m. (116) *Wavelet decompositions via multiresolution.* **Carl de Boor**, University of Wisconsin, Madison, **Ronald A. DeVore**, University of South Carolina, and **Amos Ron***, University of Wisconsin, Madison (873-41-239) (Sponsored by Xingping Sun)

4:00 p.m. (117) *L^p properties of multivariate cardinal splines.* Preliminary report. **W. R. Madych**, University of Connecticut, Storrs (873-41-206)

4:30 p.m. (118) *An analytic monotone extension of boundary data.* **Xingping Sun** and **Xiangming Yu***, Southwest Missouri State University (873-41-240)

5:00 p.m. (119) *Univariant appproximation by superpositions of a sigmoidal function.* **Bo Gao**, Temple University, and **Yuan Xu***, University of Arkansas, Little Rock (873-41-156)

Special Session on Geometry of Affine Space, II

3:00 p.m.–5:50 p.m. Room 346, Glass Hall

3:00 p.m. (120) *G_a actions on C^n and primitive ideals in enveloping algebras of nilpotent Lie algebras.* Preliminary report. **David R. Finston*** and **Mai Gehrke**, New Mexico State University, Las Cruces (873-14-73)

3:30 p.m. (121) *On Jacobian conjecture.* **T. T. Moh**, Purdue University, West Lafayette (873-13-55)

4:00 p.m. (122) *Homotopy of sections of projective modules.* **Satyagopol Mandal**, University of Kansas (873-13-68)

4:30 p.m. (123) *On the automorphisms of $k[X, Y, Z]$.* Preliminary report. **Gene Freudenburg**, Washington University (873-14-60)

5:00 p.m. Informal Discussion

Session on Combinatorics, Applications, Geometry and Topology

3:00 p.m.–4:30 p.m. Room 347, Glass Hall

3:00 p.m. (124) *Counting vetices and edges in Penrose tilings.* **Catherine A. Gorini***, Maharishi International University, and **Robert L. Wofford**, Livingston Manor, New York (873-51-82)

3:20 p.m. (125) *Dependence systems: Mappings, constructions, congruences.* **Marcin Jan Schroeder**, Southern Illinois University (873-06-141)

3:40 p.m. (126) *Expansiveness and shift homeomorphisms.* **Fred Worth**, Henderson State University (873-54-142)

4:00 p.m. (127) *Studies on optimum preventive maintenance policies for general repair result.* **Hai-yan Gu**, Shanghai University of Technology, China (873-60-22) (Sponsored by Andy R. Magid)

4:20 p.m. (128) *Semimodules and generalizations of the algebra of binary relations.* Preliminary report. **Jack M. Anderson*** and **Fan Zhang**, South Dakota State University (873-20-244)

Saturday, March 21

Special Session on Combinatorics and Discrete Geometry, III

8:00 a.m.–10:50 a.m. Room 230, Glass Hall

8:00 a.m. (129) *Placing the d-cube in Lexicographic order.* Preliminary report. **Fariba Bigdeli**, Kentucky State University (873-52-129) (Sponsored by Margaret M. Bayer)

8:30 a.m. (130) *A combinatorial decomposition of simplicial complexes.* **Art Duval**, University of Texas, El Paso (873-05-104)

9:00 a.m. (131) *H-shellings and h-complexes.* **Paul H. Edelman*** and **Victor Reiner**, University of Minnesota, Minneapolis (873-05-17)

9:30 a.m. (132) *Convex polytopes and stress.* Preliminary report. **Carl W. Lee**, University of Kentucky (873-52-39)

10:00 a.m. (133) *Lemke paths on simple polytopes.* **Walter D. Morris, Jr.**, George Mason University (873-90-130) (Sponsored by Margaret M. Bayer)

10:30 a.m. (134) *Combinatorial conditions for freeness of modules of piecewise polynomials.* **Lauren L. Rose**, Wellesley College (873-05-184)

Special Session on Partial Differential Equations, III

8:00 a.m.–10:50 a.m. Room 227, Glass Hall

8:00 a.m. Informal Discussion

8:30 a.m. (135) *Uniqueness results for semilinear elliptic equations.* **Man Kam Kwong***, Argonne National Laboratory, and **Yi Li**, University of Rochester (873-35-229)

9:00 a.m. (136) *The effect of the domain geometry on the number of positive solutions for nonlinear Neumann problems with critical exponents.* **Zhi-Qiang Wang**, Utah State University (873-35-214) (Sponsored by Russell C. Thompson)

9:30 a.m. (137) *Heat flow of P-harmonic maps with values into spheres.* **Yun-mei Chen***, University of Florida, and **Min-chun Hong**, ICTP, Italy (873-35-215)

10:00 a.m. (138) *On strongly nonlinear operator equations and applications.* **P. S. Milojevic**, New Jersey Institute of Technology (873-35-176)

10:30 a.m. Informal Discussion

Special Session on Commutative Algebra, IV

8:00 a.m.–10:50 a.m. Room 343, Glass Hall

8:00 a.m. (139) *Homological invariants of powers of ideals.* **Vijay Kodiyalam**, Purdue University, West Lafayette (873-13-81)

8:30 a.m. (140) *Integral uppers over Henselian domains.* **Chandni Shah**, University of Texas, Austin (873-13-138)

9:00 a.m. (141) *Chern classes of matrices.* **Paul C. Roberts**, University of Utah (873-13-76)

Saturday, March 21 (cont'd)

9:30 a.m. (142) *Chow groups of a regular local ring.* **S. P. Dutta**, University of Illinois, Urbana-Champaign (873-13-47)

10:00 a.m. (143) *Annihilation of homology of certain finite free complexes.* **Cameron Wickham**, Southwest Missouri State University (873-13-122)

10:30 a.m. (144) *Structure of a local homomorphism.* **Luchezar L. Avramov***, Purdue University, West Lafayette, **Hans-Bjorn Foxby**, University of Copenhagen, Denmark, and **Bernd Herzog**, Leipzig University, Germany (873-13-136)

Special Session on Lie Algebras, Cohomology and New Applications to Quantum Mechanics, III

8:00 a.m.–10:50 a.m. Room 237, Glass Hall

8:00 a.m. (145) *Asymptotic expansion in momentum of the time-dependent Schrödinger equation.* **D. J. Kaup**, Clarkson University (873-81-205)

8:30 a.m. Informal Discussion

9:00 a.m. (146) *Representations of quantum algebras and applications.* **Luc Vinet**, University of Montreal (873-20-243) (Sponsored by Peter J. Olver)

9:30 a.m. (147) *Differential operators and trees on algebraic groups.* **Robert Grossman**, University of Chicago (873-17-236)

10:00 a.m. (148) *Quasi-exactly solvable spectral problems and conformal field theory.* **Mikhail A. Shifman**, University of Minnesota, Minneapolis (873-81-186) (Sponsored by Peter J. Olver)

10:30 a.m. (149) *Exact solutions to operator differential equations.* **Carl M. Bender**, Washington University (873-81-204) (Sponsored by Peter J. Olver)

Special Session on C*-Algebras and Algebraic Topology, III

8:00 a.m.–10:50 a.m. Room 344, Glass Hall

8:00 a.m. (150) *Dixmier-Douady classes of dynamical systems and crossed products.* Preliminary report. **Iain Raeburn**, University of Newcastle, Australia, and **Dana P. Williams***, Dartmouth College (873-46-40)

8:30 a.m. (151) *Unbounded Fredholm modules and automorphisms of C*-algebras.* **Efton Park**, Indiana University-Purdue University, Indianapolis (873-46-59)

9:00 a.m. (152) *KK theory and Lie groups.* **Jeffrey Fox**, State University of New York, Albany and Univeristy of Colorado, Boulder, and **Peter Haskell***, Virginia Polytechnic Institute and State University (873-46-24)

9:30 a.m. (153) *Traces on twisted group C^*-algebras and cyclic cohomology.* Preliminary report. **Ronghui Ji**, Indiana University-Purdue University, Indianapolis (873-46-28)

10:00 a.m. (154) *C^*-surgery obstructions.* **John G. Miller**, Indiana University-Purdue University, Indianapolis (873-58-96)

10:30 a.m. (155) *K-theory and homotopy of certain groups and infinite Grassmann spaces associated with C^*-algebras.* **Shuang Zhang**, University of Cincinnati (873-46-44)

Special Session on The Geometry of Connections, III

8:20 a.m.–10:50 a.m. Room 342, Glass Hall

8:20 a.m. (156) *The spectrum of the Laplacian on manifolds of positive curvature.* **Jose F. Escobar**, Indiana University, Bloomington (873-53-170)

9:00 a.m. (157) *Pointwise curvature characterizations in practice.* Preliminary report. **Walter Seaman**, University of Iowa (873-53-189) (Sponsored by Luis Hernandez)

9:40 a.m. (158) *Non self-dual Yang-Mills connections with quadrupole symmetry.* **Jan Segert***, University of Missouri, Columbia, and **Lorenzo Sadun**, University of Texas, Austin (873-81-75)

10:20 a.m. (159) *The inverse problem of Lagrangian dynamics.* **Gerard Thompson**, University of Toledo (873-58-63) (Sponsored by Geoffrey K. Martin)

Special Session on Classical Complex Analysis and Related Areas, III

8:30 a.m.–10:50 a.m. Room 340, Glass Hall

8:30 a.m. (160) *Cauchy data for divergence form elliptic equations.* Preliminary report. **Thomas H. Wolff**, California Institute of Technology (873-35-118) (Sponsored by Michael Aschbacher)

9:00 a.m. (161) *On a conditional theorem of Littlewood for quasiregular entire functions.* Preliminary report. **John Lewis**, University of Kentucky (873-30-147)

9:30 a.m. (162) *On the dimension of the range of a quasiconformal mapping.* Preliminary report. **Matti Vuorinen**, University of Helsinki, Finland and University of Michigan, Ann Arbor (873-30-237)

10:00 a.m. (163) *Distortion of area and conditioned Brownian motion.* **P. Griffin**, **G. Verchota** and **A. Vogel***, Syracuse University (873-30-209)

10:30 a.m. (164) *Gap theorems for differentially algebraic functions.* Preliminary report. **Georg Martin Reinhart**, University of Illinois, Urbana-Champaign (873-30-134)

Special Session on Semigroups, III

8:30 a.m.–10:50 a.m. Room 345, Glass Hall

8:30 a.m. (165) *Congruences on left Clifford semigroup.*
Kar-Ping Shum, Chinese University of Hong Kong, Hong Kong (873-20-115)

9:00 a.m. (166) *The congruence extension property for semigroups.* Preliminary report.
Peter R. Jones, Marquette University (873-20-94)

9:30 a.m. (167) *Semigroups of order* 8.
Masamichi Tokizawa, Chuo University, Japan (873-20-123) (Sponsored by Boris M. Schein)

10:00 a.m. (168) *On the elementary theories of relatively free semigroups.*
Bella V. Rozenblat, Open University, Israel (873-20-140) (Sponsored by Boris M. Schein)

10:30 a.m. (169) *Commutative semigroup cohomology.*
Pierre A. Grillet, Tulane University (873-20-08)

Special Session on Harmonic Analysis, III

9:00 a.m.–10:50 a.m. Room 262, Glass Hall

9:00 a.m. (170) *On the duality for the generalized Lorentz spaces.*
Sadahiro Saeki, Kansas State University (873-46-165)

9:30 a.m. (171) *Superharmonic functions in Holder domains.* Preliminary report.
David Stegenga, University of Hawaii, and **David Ullrich***, Oklahoma State University, Stillwater (873-31-51) (Sponsored by Alan V. Noell)

10:00 a.m. (172) *A probabilistic proof of Furstenberg's theorem.*
Andrew G. Bennett, Kansas State University (873-60-111)

10:30 a.m. (173) *A representation of N_α^+ as a union of weighted Hardy spaces.*
C. M. Eoff, University of Arkansas, Fayetteville (873-30-191)

Special Session on Approximation Theory, III

9:00 a.m.–10:50 a.m. Room 226, Glass Hall

9:00 a.m. (174) *Multivariate probabilistic approximation in wavelet structure.*
George Anastassiou*, Memphis State University, and **Xiang Ming Yu**, Southwest Missouri State University (873-41-06)

9:30 a.m. (175) *Constructive ridge function approximation.*
E. W. Cheney*, University of Texas, Austin, **W. A. Light**, University of Leicester, England, and **Yuan Xu**, University of Arkansas, Little Rock (873-41-87)

10:00 a.m. (176) *Good polynomial approximations of functions and their derivatives in $L^p[-1,1]$.* Preliminary report.
Theodore Kilgore, Auburn University, Auburn (873-41-173)

10:30 a.m. (177) *A short proof of Burdzy's theorem on the angular derivative.*
Stephen J. Gardiner, McGill University and Univeristy College, Ireland (873-41-235)

Special Session on Geometry of Affine Space, III

9:00 a.m.–10:50 a.m. Room 346, Glass Hall

9:00 a.m. (178) *Purely inseparable extensions of $k[X,Y]$.*
Daniel Daigle, University of Ottawa (873-14-92) (Sponsored by David Wright)

9:30 a.m. (179) *Smooth contractable hypersurfaces in C^n and exotic algebraic structures on C^3.*
Shulim Kaliman, University of Miami (873-14-56)

10:00 a.m. (180) *Polynomials with smooth fibers and linear differential operators generated by them.* Preliminary report.
Yosef Stein, Center of Technological Education, Israel (873-14-113) (Sponsored by David Wright)

10:30 a.m. (181) *Discriminant criterion in characteristic two: Calculations and applications.* Preliminary report.
Shreeram Abhyankar, **Jun Ou**, Purdue University, West Lafayette, and **Avinash Sathaye***, University of Kentucky (873-14-91)

Session on Analysis, I

9:20 a.m.–10:10 a.m. Room 347, Glass Hall

9:20 a.m. (182) *The spectral radius of layer-potential operators on convex sets in R^n.*
Mark Sand, Northwest Missouri State University (873-31-62)

9:40 a.m. (183) *Removable singular set of solutions of variational problems.*
Libin Mou, University of Southern California (873-35-86)

10:00 a.m. (184) *Generalizing the contraction condition for non-linear semi-groups.* Preliminary report.
David Gurney, Southeastern Louisiana University (873-46-145)

Invited Address

11:00 a.m.–11:50 a.m. Hutchens Auditorium, Glass Hall

(185) *Recent progress in value distribution theory.*
Alexander E. Eremenko, Institute of Low Temperature Physics & Engineering, USSR (873-99-201)

Invited Address

1:30 p.m.–2:20 p.m. Hutchens Auditorium, Glass Hall

(186) *Algorithms based on guessing: Infinitely nested priority arguments.* Preliminary report.
Julia F. Knight, University of Notre Dame (873-03-233)

Saturday, March 21 (cont'd)

Special Session on Harmonic Analysis, IV

3:00 p.m.–4:50 p.m. Room 262, Glass Hall

3:00 p.m. (187) *A remark on singular integrals and power weights.* **Fernando Soria**, University Autonoma de Madrid, Spain, and **Guido Weiss***, Washington University (873-42-14)

3:30 p.m. (188) *Spheroidal wave functions and hypergroups.* **Clemens Markett**, Rheinisch-West Technological University, Germany, **William C. Connett*** and **Alan L. Schwartz**, University of Missouri at St Louis (873-33-117)

4:00 p.m. (189) *Orthogonal polynomials in several variables and hypergroups.* **William C. Connett** and **Alan L. Schwartz***, University of Missouri, St. Louis (873-41-116)

4:30 p.m. (190) *Special atomic decomposition of Besov spaces on fractal sets.* **Geraldo De Souza***, Auburn University, and **Archil Gulisashvili**, Georgia Academy of Sciences, USSR (873-46-05)

Special Session on Combinatorics and Discrete Geometry, IV

3:00 p.m.–5:20 p.m. Room 230, Glass Hall

3:00 p.m. (191) *Perfect matchings and perfect squares.* **William Jockusch**, Massachusetts Institute of Technology (873-05-78)

3:30 p.m. (192) *Combinatorial triality.* **Jon Phillips**, Iowa State University (873-05-23)

4:00 p.m. (193) *Transversals for polytopes.* **N. Prabhu**, Purdue University, West Lafayette (873-05-227)

4:30 p.m. (194) *A class of Greedoids derived from matroids.* Preliminary report. **Mark Purtill**, Institute for Defense Analysis and Communications Research Division, New Jersey (873-05-48)

5:00 p.m. (195) *Veldkamp spaces.* Preliminary report. **Ernest E. Shult**, Kansas State University (873-51-157)

Special Session on Partial Differential Equations, IV

3:00 p.m.–6:50 p.m. Room 227, Glass Hall

3:00 p.m. (196) *Nonexistence of non-parametric minimal submanifolds with prescribed boundary.* **Zhiren Jin**, University of Michigan, Ann Arbor (873-35-70)

3:30 p.m. (197) *Ricci flow on manifolds with boundary generalized Weyl problem.* Preliminary report. **Georgi Kamberov**, Rice University (873-53-213)

4:00 p.m. (198) *Density condition at infinity and resonance in nonlinear elliptic equations.* **M. N. Nkashama**, University of Alabama, Birmingham (873-35-180)

4:30 p.m. (199) *Regularity of higher-dimensional gauge fields.* **Thomas Otway**, Yeshiva University (873-35-100)

5:00 p.m. (200) *Finite extinction time for solutions of nonlinear parabolic equations.* Preliminary report. **Alan V. Lair**, Air Force Institute of Technology (873-35-61)

5:30 p.m. (201) *Hyperbolic degeneracy and blow-up.* **Ralph Saxton**, University of New Orleans (873-35-150) (Sponsored by Katarzyna Saxton)

6:00 p.m. (202) *Prescribing Gaussian curvature on surfaces with conical singularities.* **Wenxiong Chen***, Southwest Missouri State University, and **Congming Li**, Institute for Advanced Study (873-35-161)

6:30 p.m. (203) *A Neumann problem in subdomain of S^2.* **Kanghui Guo** and **Shou Chuan Hu***, Southwest Missouri State University (873-35-195)

Special Session on Commutative Algebra, IV

3:00 p.m.–5:50 p.m. Room 343, Glass Hall

3:00 p.m. (204) *Indecomposable Cohen-Macaulay modules over one-dimensional rings.* **Roger Wiegand** and **Sylvia Wiegand***, University of Nebraska, Lincoln (873-13-88)

3:30 p.m. Informal Discussion

4:00 p.m. (205) *Purity theorems for schemes of small deviation.* **S. D. Cutkosky**, University of Missouri, Columbia (873-13-164)

4:30 p.m. (206) *Modules approximated by projectives.* **Roger Wiegand**, University of Nebraska, Lincoln (873-13-65)

5:00 p.m. (207) *Descent properties.* **D. Weston**, University of Missouri, Columbia (873-13-242)

5:30 p.m. (208) *Flatness of diagonal Rees algebras.* Preliminary report. **Gary Kennedy**, Ohio State University, Mansfield (873-13-135)

Special Session on The Geometry of Connections, IV

3:00 p.m.–6:10 p.m. Room 342, Glass Hall

3:00 p.m. (209) *Mean curvature of gauge orbits.* Preliminary report. **Yohiaki Maeda**, Keio University, Japan, **Steven Rosenberg**, Boston University, and **Philippe Tondeur***, University of Illinois, Urbana-Champaign (873-58-90)

3:30 p.m. (210) *On the structure of complete embedded simply connected minimal surfaces.* **Frederico Xavier**, University of Notre Dame (873-53-188)

4:00 p.m. (211) *Hamilton-Jacobi distributions and almost Hermitian geometry on the cotangent bundle.* **Geoffrey Martin**, University of Toledo (873-53-67)

4:30 p.m. (212) *The functional logdet and the geometry of the space of nonparametrised curves on a surface.* Preliminary report.
Dan Burghelea, Ohio State University, Columbus (873-53-103)

5:00 p.m. (213) *Holomorphic curves in $SO(6)/U(3)$.*
Andrew V. Talmadge* and **Kichoon Yang**, Arkansas State University (873-53-69)

Special Session on Classical Complex Analysis and Related Areas, IV

3:00 p.m.–4:50 p.m. Room 340, Glass Hall

3:00 p.m. (214) *The space BMO and Teichmüller theory.* Preliminary report.
Michel Zinsmeister*, University of Bordeaux, France and University of Michigan, Ann Arbor, and **Kari Astala**, University of Helsinki, Finland (873-30-222) (Sponsored by Jang-Mei Wu)

3:30 p.m. (215) *On the zeros of the derivative of a meromorphic function.*
A. Eremenko, Purdue University, West Lafayette, **J. Langley**, Univeristy of Nottingham, England, and **J. Rossi***, Virginia Polytech Institute & State University (873-30-223)

4:00 p.m. (216) *Circle packings and analytic function theory.* Preliminary report.
Ken Stephenson, University of Tennessee, Knoxville (873-30-99)

4:30 p.m. Informal Discussion

Special Session on Lie Algebras, Cohomology and New Applications to Quantum Mechanics, IV

3:00 p.m.–4:50 p.m. Room 237, Glass Hall

3:00 p.m. (217) *Algebraic approach to scattering.*
Y. Alhassid, Yale University (873-08-203) (Sponsored by Peter J. Olver)

3:30 p.m. (218) *Scattering theory and the group representation matrix.*
Joseph N. Ginocchio, Los Alamos National Laboratory (873-81-179) (Sponsored by Peter J. Olver)

4:00 p.m. (219) *Some results regarding low-order Hamiltonian operators.*
David B. Cooke, Hastings College (873-35-181)

4:30 p.m. (220) *Embeddings of a Lie algebra into its universal envoloping algebra.*
V. Ovsienko* and **A. V. Turbiner**, University de Luminy, France (873-22-200) (Sponsored by Peter J. Olver)

Special Session on C*-Algebras and Algebraic Topology, IV

3:00 p.m.–6:20 p.m. Room 344, Glass Hall

3:00 p.m. (221) *K-theory of C^*-algebras deformed by actions of R^d.* Preliminary report.
Marc A. Rieffel, University of California, Berkeley (873-46-10)

3:30 p.m. (222) *Spatial deformation quantization for C^*-algebras.*
Gabriel Nagy, University of California, Berkeley (873-47-187) (Sponsored by Marc A. Rieffel)

4:00 p.m. (223) *The rectifiable metric on the space of projections in a C^*-algebra.*
N. Christopher Phillips, University of Oregon (873-46-49)

4:30 p.m. (224) *Cuntz-Krieger algebras associated with Fuchsian groups.*
Jack Spielberg, Arizona State University (873-46-185)

5:00 p.m. (225) *Primitive ideal spaces of central twisted crossed product C^*-algebras.* Preliminary report.
Lawrence Baggett and **Judith A. Packer***, University of Colorado, Boulder (873-46-29)

5:30 p.m. (226) *Projective C^*-algebras.*
Terry A. Loring, University of New Mexico (873-46-219)

6:00 p.m. (227) *Cohomology for operator algebras.*
Frank Gilfeather*, University of New Mexico, and **Roger R. Smith**, Texas A & M University, College Station (873-47-57)

Special Session on Semigroups, IV

3:00 p.m.–5:50 p.m. Room 345, Glass Hall

3:00 p.m. (228) *Q-universal quasivarieties of algebras.*
M. E. Adams*, State University of New York, College at New Paltz, and **W. Dziobiak**, N. Copernicus Univeristy, Poland (873-20-84)

3:30 p.m. (229) *Semigroup varieties closed for the Bruck extension.*
Francis J. Pastijn* and **Xiaoying Yan**, Marquette University (873-20-35)

4:00 p.m. (230) *Varieties of inverse semigroups and strongly unsolvable word problem.*
John C. Meakin and **Mark V. Sapir***, University of Nebraska, Lincoln (873-20-139)

4:30 p.m. (231) *Inverse algebras.* Preliminary report.
Jonathan Leech, Westmont College (873-20-95)

5:00 p.m. (232) *One-relator orthogroups.* Preliminary report.
K. S. Ajan, Marquette University (873-20-34)

5:30 p.m. (233) *The height of the set of principal ideals in the semigroup of binary relations.*
Mike Breen, Tennessee Technological University (873-20-20)

Special Session on Geometry of Affine Space, IV

3:00 p.m.–5:20 p.m. Room 346, Glass Hall

3:00 p.m. (234) *Orthogonal and symplectic matrix invariants.* Preliminary report.
George Seelinger, Northern Illinois University (873-14-93)

3:30 p.m. (235) *Unramified coverings of the affine line in nonzero characteristic.*
Shreeram S. Abhyankar, Purdue University, West Lafayette (873-14-13)

4:00 p.m. (236) *On the face problem for automorphisms and birational maps of affine spaces.*
Wei Li*, McGill University, and **Jietai Yu**, University of Notre Dame (873-14-18)

Saturday, March 21 (cont'd)

4:30 p.m. (237) *Power-exact, nilpotent, homogeneous matrices and ten questions about Keller's Jacobian conjecture.* **Gary Meisters***, University of Nebraska, Lincoln, and **Czeslaw Olech**, Polish Academy of Sciences, Poland (873-15-125)

5:00 p.m. (238) *Rationally triangulable G_a actions.* Preliminary report. **James K. Deveney***, Virginia Commonwealth University, and **David Finston**, New Mexico State University, Las Cruces (873-12-50)

Session on Analysis, II

3:00 p.m.–3:50 p.m. Room 347, Glass Hall

3:00 p.m. (239) *Boolean lattices of function algebras on rectangular groups in Euclidean spaces.* **Hassan Sedaghat**, Virginia Commonwealth University (873-22-77)

3:20 p.m. (240) *On the deficiencies of oriented functions.* **Arturo Fernandez Arias**, Universidad a Distancia, Spain and University of Wisconsin, Madison (873-31-208) (Sponsored by Daniel F. Shea)

3:40 p.m. (241) *Invariant extensions of holomorphic motions.* Preliminary report. **Zbigniews Slodkowski**, University of Illinois, Chicago (873-30-234)

Andy R. Magid
Associate Secretary
Norman, Oklahoma

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Volume 5
Reliability of Computer and Communication Networks

Frank Hwang, Clyde Monma, and Fred Roberts, Editors

This workshop, held at Rutgers University, emphasized the latest trends and important open problems concerning the reliability of increasingly complex modern systems of telecommunications, information transmissions, transportation, and distribution. Participants of the workshop included theoretical mathematicians, computer scientists, and electrical engineers from academia and industry. The success of the workshop in fostering many new interactions among researchers and practitioners is reflected in the proceedings, which provide an exciting look at some of the major advances at the forefront of this important field of research.

1991 Mathematics Subject Classifications: 05, 68, 90, 94
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Bethlehem, Pennsylvania
Lehigh University
April 11–12, 1992

Second Announcement

The eight-hundred-and-seventy-fourth meeting of the American Mathematical Society (AMS) will be held at Lehigh University in Bethlehem, Pennsylvania on Saturday and Sunday, April 11 and 12, 1992. All special sessions and sessions for contributed papers will be held in the Christmas-Saucon Hall and in the Seeley G. Mudd Building. The invited addresses will be in Neville Auditorium I.

Invited Addresses

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

Jean-Luc Brylinski, Pennsylvania State University, University Park, *Geometry of characteristic classes*, 1:30 p.m., Sunday, April 12.

Ingrid Daubechies, AT&T Bell Labs, *On some functions with weird differentiability properties*, 1:30 p.m., Saturday, April 11.

Edward Y. Miller, Polytechnic University, *Spectral flow, small eigenvalues and symplectic geometry applied to 3-manifolds*, 11:00 a.m., Sunday, April 12.

Douglas Ravenel, University of Rochester, *The nilpotence and periodicity theorems in homotopy theory*, 11:00 a.m., Saturday, April 11.

Special Sessions

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

Finite geometry, **E. F. Assmus Jr.**, Lehigh University; and **Jennifer D. Key**, Clemson University.

Sequence spaces, **Grahame Bennett**, Indiana University; **Jeffrey S. Connor**, Ohio University, Athens; and **Andrew K. Snyder**, Lehigh University.

Characteristic classes, algebraic K-theory, and field theory, **Jean-Luc Brylinski** and **Dennis A. McLaughlin**, Princeton University.

Homotopy theory, **Donald M. Davis**, Lehigh University, and **Douglas Ravenel**.

Geometric analysis, **David L. Johnson** and **Penny Smith**, Lehigh University.

New invariants of links and 3-manifolds, **Xiao-Song Lin**, Columbia University.

Set theory, **Lee J. Stanley**, Lehigh University.

Stochastic processes, **Joseph E. Yukich**, Lehigh University.Abstracts for consideration for these sessions should have been submitted by the **January 2, 1992** deadline. This deadline was previously published in the Calendar of AMS Meetings and Conferences and in the Invited Speakers and Special Sessions section of *Notices*.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts for consideration of these sessions should have been submitted by the **January 30, 1992** deadline previously published in the Calendar of AMS Meetings and Conferences. Late papers will not be accommodated.

Conference on Finite Geometry

The above mentioned special session on *Finite geometry* constitutes the first two days of a four-day conference on *Finite geometry* to be funded by NSA and perhaps by NSF. Persons interested in the Monday and Tuesday activities of the conference should contact the Project Director, E. F. Assmus, Jr., Department of Mathematics, Building 14, Lehigh University, Bethlehem, PA 18015 or via e-mail at efa0@ns.cc.lehigh.edu.

Electronic Submission of Abstracts

This service is available to those who use the TEX typesetting system and can be used with abstracts of papers to be presented at the sectional meetings of the AMS. Requests to obtain the package of files may be sent electronically on Internet to **abs-request@math.ams.com**. Requesting the files electronically will likely be the fastest and most convenient way, but users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to: Abstracts Coordinator, American Mathematical Society, Meetings Department, P.O. Box 6887, Providence, RI 02940, USA. When requesting the abstracts package, users should be sure to specify whether they want the plain TEX, AMS-TEX, or the LATEX package.

Registration

The meeting registration desk will be located in the lobby of Neville Hall The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians.

Social Event

A reception and banquet will be held at 6:30 p.m. on Saturday, April 11, 1992 in honor of Professor Albert (Tommy) Wilansky on his retirement from Lehigh University after forty-four years of service. The event will be held in the Asa Packer Room of the University Center. Arrangements to attend must be made directly with Andrew K. Snyder, Department of Mathematics, Building 14, Lehigh University, Bethlehem, PA 18015 (indicate ATTN: Banquet). Enclose a check for $25 made out to Department of Mathematics. Reservations and payment must be received by Friday, March 27, 1992. Seating is limited.

Accommodations

Rooms have been blocked for participants at the Hotel Bethlehem, Econo Lodge, and the McIntosh Inn. Participants should make their own arrangements with the hotel of their choice and mention the AMS meeting at Lehigh University to obtain the rates listed below. All rates are subject to a six percent sales tax. **The AMS is not responsible for rate changes or the quality of the accommodations offered by these hotels/motels.**

Hotel Bethlehem (Twenty-minute walk from Neville Hall)
437 Main Street, Behtlehem, PA 18018
Telephone: 215-867-3711
The deadline for reservations is March 26.
Single $60 Double $72

Econo Lodge (Ten minutes by car from Neville Hall)
Catasauqua Road, Bethlehem, PA 18018
Telephone: 215-867-8681
The deadline for reservations is March 26.
Single $36.95 Double $42.95

McIntosh Inn (Ten minutes by car from Neville Hall)
Rt. 22 & Airport Road, Allentown, PA 18103
Telephone: 800-444-2775
The deadline for reservations is April 1.
Single $34.95 Double $40.95

Food Service

There are numerous restaurants and fast food establishments within a short walk of Neville Hall, and several Lehigh University cafeterias will be open on a cash basis. A list of these restaurants will be available at the registration desk.

Parking

Parking is permitted and free of charge during daytime and evening hours on Saturday and Sunday in several Lehigh lots adjacent to the registration area. Three large lots are located just north of Neville Hall and several smaller lots are nearby.

Travel and Local Information

The Allentown-Bethlehem-Easton International Airport is served by major airlines including American, Continental, Delta, Northwest, United, and USAir. There is nonstop jet service from Atlanta, Chicago, Detroit, and Pittsburgh and commuter flights from Baltimore, Boston, New York, Philadelphia, Providence, and Washington, D.C. Taxi service can be arranged from the airport to the meeting site (approximately a ten-minute ride).

Bus service to Bethlehem includes Trans Bridge Lines from the New York area, Greyhound-Trailways from Pittsburgh and Harrisburg, and Carl R. Bieber Tourways from Philadelphia.

ARRIVING BY AUTOMOBILE: Driving from the New York City area: Take route 22 west and exit at the last Bethlehem exit, Route 378. Route 378 heads only south; continue for 3.6 miles and cross the bridge over the Lehigh River being careful to stay in the left lane. At the far end of the bridge, turn left at the traffic light for Third Street; continue one block to the traffic light at Brodhead Avenue and turn right; Continue three blocks to the stop sign at Packer Avenue, and turn left. Neville Hall is approximately two blocks on your left.

Driving from western points: Take Route 22 east, exiting at Route 378, which is the first of three Bethlehem exits. Continue south as described above.

Arriving from Philadelphia: Take the Northeast Extension of the Pennsylvania Turnpike north to Exit 33 (Lehigh Valley), then head east on Route 22 and follow the directions from western points.

Weather and Local Attractions

The average high temperature in Bethlehem in April is 61°F and the average low is 39°F. The average rainfall for the month is 3.9 inches.

Points of interest in the area reflect the history of Bethlehem since its founding by Moravians in 1741 and most are within walking distance of the meeting site and Hotel Bethlehem. An 18th century industrial area consists of restored and partially reconstructed mills. Nearby museums and sites include Gemeinhaus (Moravian Museum), Central Moravian Church and God's Acre, The Apothecary Museum, 1758 Sun Inn, and the Kemerer Museum of Decorative Arts.

Institutes of higher education in the Allenton-Bethlehem-Easton area include Cedar Crest, Lafayette, Moravian, and Muhlenberg Colleges and Lehigh University.

W. Wistar Comfort
Associate Secretary
Middletown, Connecticut

Invited Addresses and Special Sessions

Invited Addresses at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places indicated. For some meetings, the list of speakers is incomplete.

Bethlehem, PA, April 1992

Please see the announcement of this meeting elsewhere in this issue.

Cambridge, England, June 1992

(Joint meeting with the London Mathematical Society)
Please see the announcement of this meeting in the January issue.

Dayton, OH, October 1992

Martin Golubitsky
Jonathan I. Hall
Louis H. Kauffman
J. T. Stafford

San Antonio, TX, January 1993

Luis A. Caffarelli
(Colloquium Lectures)

Washington, DC, April 1993

Fan R. K. Chung
Leopold Flatto
Joel Spruck
A. Zamolodchikov

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

Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of *Notices* went to the printer. The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

April 1992 Meeting in Bethlehem, Pennsylvania

Eastern Section
Associate Secretary: W. Wistar Comfort
Deadline for organizers: Expired
Deadline for consideration: Expired

Please see the announcement elsewhere in this issue.

June 1992 Meeting in Cambridge, England

(Joint Meeting with the London Mathematical Society)
Associate Secretary: Robert M. Fossum
Deadline for organizers: Expired
Deadline for consideration: February 7, 1992

Please see the announcement in the January issue.

October 1992 Meeting in Dayton, Ohio

Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: July 13, 1992

Colin C. Adams and Ara S. Basmajian, *Hyperbolic manifolds*
Carolyn A. Dean, Timothy J. Hodges, and J. Toby Stafford, *Quantum groups and regular algebras*
Joanne M. Dombrowski and Richard Mercer, *Operator theory and operator algebras*
Anthony B. Evans and Terry A. McKee, *Combinatorics and graph theory*
Daniel E. Frohardt, *Finite groups and finite geometries*
Lop Fat Ho, Srdjan D. Stojanovic and Thomas Svobody, *Control theory and partial differential equations*
Muhammud N. Islam and Lawrence Turyn, *Differential and integral equations*
Louis H. Kauffman, *Knots and topological quantum field theory*
Hendrik J. Kuiper and Tapas Mazumdar, *Ricatti equations and transport theory*
Anatoly S. Libgober and Stephen Sperber, *Topology of affine hypersurfaces and related number theory*
Joe D. Mashburn, *Set-theoretic topology*
C. David Minda, *Function theory*

November 1992 Meeting in Los Angeles, California

Western Section Associate Secretary: Lance W. Small
Deadline for organizers: Expired
Deadline for consideration: July 13, 1992

January 1993 Meeting in San Antonio, Texas
Associate Secretary: W. Wistar Comfort
Deadline for organizers: April 13, 1992
Deadline for consideration: September 17, 1992

March 1993 Meeting in Knoxville, Tennessee
Southeastern Section
Associate Secretary:
Joseph A. Cima (until 1/31/93)
Robert J. Daverman (after 1/31/93)
Deadline for organizers: June 26, 1992
Deadline for consideration: December 15, 1992
Don B. Hinton and Kenneth Shaw, *Sturm-Liouville operators, applications, and extensions*
Balram S. Rajput and Jan Rosinski, *Stochastic processes*

April 1993 Meeting in Salt Lake City, Utah
Western Section
Associate Secretary: Lance W. Small
Deadline for organizers: July 9, 1992
Deadline for consideration: January 6, 1993

April 1993 Meeting in Washington, DC
Eastern Section
Associate Secretary:
W. Wistar Comfort (until 1/31/93)
Lesley M. Sibner (after 1/31/93)
Deadline for organizers: July 17, 1992
Deadline for consideration: January 6, 1993

May 1993 Meeting in DeKalb, Illinois
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: August 21, 1992
Deadline for consideration: February 3, 1993

August 1993 Meeting in Vancouver, British Columbia, Canada
Associate Secretary: Lance W. Small
Deadline for organizers: November 11, 1992
Deadline for consideration: April 27, 1993

October 1993 Meeting in College Station, Texas
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: January 22, 1993
Deadline for consideration: July 14, 1993

January 1994 Meeting in Cincinnati, Ohio
Associate Secretary:
Joseph A. Cima (until 1/31/93)
Robert J. Daverman (after 1/31/93)
Deadline for organizers: April 5, 1993
Deadline for consideration: September 23, 1993

March 1994 Meeting in Lexington, Kentucky
Southeastern Section
Associate Secretary:
Joseph A. Cima (until 1/31/93)
Robert J. Daverman (after 1/31/93)
Deadline for organizers: June 18, 1992
Deadline for consideration: To be announced

March 1994 Meeting in Manhattan, Kansas
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: June 25, 1993
Deadline for consideration: To be announced

January 1995 Meeting in Denver, Colorado
Associate Secretary: Andy R. Magid
Deadline for organizers: April 20, 1994
Deadline for consideration: To be announced

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

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

Information for Organizers

Special Sessions at Annual and Summer Meetings are held under the supervision of the Program Committee for National Meetings (PCNM). They are administered by the Associate Secretary in charge of that meeting with staff assistance from the Meetings Department in the Society office in Providence.

According to the "Rules for Special Sessions" of the Society, Special Sessions are selected by the PCNM from a list of proposed Special Sessions in essentially the same manner as individuals are selected to give Invited Addresses. The number of Special Sessions at a Summer or Annual Meeting is limited. The algorithm that determines the number of Special Sessions allowed at a given meeting, while simple, is not repeated here, but can be found in "Rules for Special Sessions" on page 614 in the April 1988 issue of *Notices*.

Each person selected to give an Invited Address is invited to generate a Special Session, either by personally organizing one or by having a Special Session organized by others. Proposals to organize a Special Session are sometimes requested either by the PCNM or by the Associate Secretary. Other proposals to organize a Special Session may be submitted to the Associate Secretary in charge of that meeting (who is an *ex-officio* member of the committee and whose address may be found below). These proposals must be in the hands of the PCNM at least nine months prior to the meeting at which the Special Session is to be held in order that the committee may consider all the proposals for Special Sessions simultaneously. Proposals that are sent to the Providence office of the Society, to *Notices*, or directed to anyone other than the Associate Secretary will have to be forwarded and may not be received in time to be considered for acceptance.

It should be noted that Special Sessions must be announced in *Notices* in such a timely fashion that any member of the Society who so wishes may submit an abstract for consideration for presentation in the Special Session before

the deadline for such consideration. This deadline is usually three weeks before the deadline for abstracts for the meeting in question.

Special Sessions are very effective at Sectional Meetings and can usually be accommodated. The processing of proposals for Special Sessions for Sectional Meetings is handled in essentially the same manner as for Annual and Summer Meetings by the Section Program Committee. Again, no Special Session at a Sectional Meeting may be approved so late that its announcement appears past the deadline after which members can no longer send abstracts for consideration for presentation in that Special Session.

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

More precise details concerning proposals for and organizing of Special Sessions may be found in the "Rules for Special Sessions" or may be obtained from any Associate Secretary.

Proposals for Special Sessions to the Associate Secretaries

The programs of Sectional Meetings are arranged by the Associate Secretary for the section in question:

Western Section

Lance W. Small, Associate Secretary
Department of Mathematics
University of California, San Diego
La Jolla, CA 92093
Electronic mail: g_small@math.ams.com
(Telephone 619-534-3590)

Central Section

Andy R. Magid, Associate Secretary
Department of Mathematics
University of Oklahoma
601 Elm PHSC 423
Norman, OK 73019
Electronic mail: g_magid@math.ams.com
(Telephone 405-325-6711)

Eastern Section

W. Wistar Comfort, Associate Secretary (until January 31, 1993)
Department of Mathematics
Wesleyan University
Middletown, CT 06457
Electronic mail: g_comfort@math.ams.com
(Telephone 203-347-9411)

Lesley M. Sibner, Associate Secretary (beginning February 1, 1993)
Department of Mathematics
Polytech University of New York
Brooklyn, NY 11201-2990
(Telephone 718-260-3505)

Southeastern Section

Joseph A. Cima, Associate Secretary (until January 31, 1993)
Department of Mathematics
University of North Carolina, Chapel Hill
Chapel Hill, NC 27599-3902
Electronic mail: g_cima@math.ams.com
(Telephone 919-962-1050)

Robert J. Daverman, Associate Secretary (beginning February 1, 1993)
Department of Mathematics
University of Tennessee
Knoxville, TN 37996-1300
(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. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

Information for Speakers

A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting at which the Special Session has been scheduled. Contributors should know that there is a limitation in size of a single Special Session, so that it is sometimes true that all places are filled by invitation. Papers not accepted for a Special Session are considered as ten-minute contributed papers.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Meetings Department, American Mathematical Society, 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. Requests to obtain the package of files may be sent electronically via the Internet to **abs-request@math.ams.com.** Requesting the files electronically will likely be the fastest and most convenient way, but users may also obtain the package on IBM or Macintosh diskettes, available free of charge by writing to: Electronic Abstracts, American Mathematical Society, Publications Division, P.O. Box 6248, Providence, RI 02940, USA. When requesting the abstracts package, users should be sure to specify whether they want the plain TEX, AMS-TEX, or the LATEX package.

Number of Papers Presented Joint Authorship

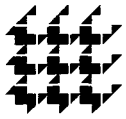
Although an individual may present only one ten-minute contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once. An author can speak by invitation in more than one Special Session at the same meeting.

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

Site Selection for Sectional Meetings

Sectional Meeting sites are recommended by the Associate Secretary for the Section and approved by the Committee

of Associate Secretaries and Secretary. Recommendations are usually made eighteen to twenty-four months in advance. Host departments supply local information, ten to twelve rooms with overhead projectors for contributed paper sessions and Special Sessions, an auditorium with twin overhead projectors for invited addresses, and registration clerks. The Society partially reimburses for the rental of facilities and equipment, and for staffing the registration desk. Most host departments volunteer; to do so, or for more information, contact the Associate Secretary for the Section.

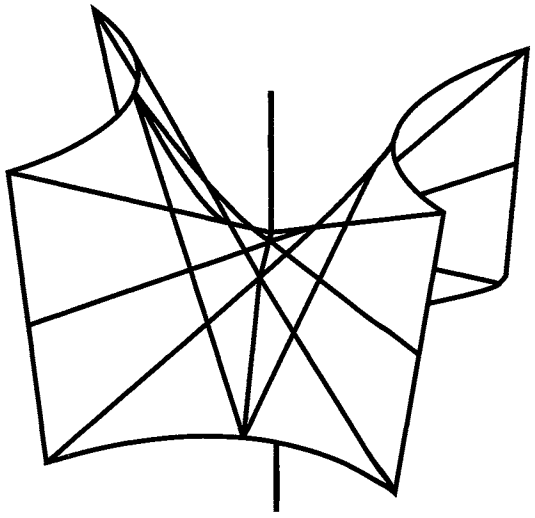


DIMACS: Series in Discrete Mathematics and Theoretical Computer Science

Discrete and Computational Geometry: Papers from the DIMACS Special Year

Volume 6

Jacob E. Goodman, Richard Pollack, and William Steiger, *Editors*



Discrete and Computational Geometry presents some of the results growing out of the workshops and the special year activities. Containing both survey articles and research papers, this collection presents an excellent overview of significant recent progress in discrete and computational geometry. The diversity of the papers demonstrates how geometry continues to provide a vital source of ideas in theoretical computer science and discrete mathematics as well as fertile ground for interaction and stimulation between the two disciplines.

1991 *Mathematics Subject Classifications*: 03, 05, 12, 13, 14, 15, 32, 51, 52, 57, 68, ISBN 0-8218-6595-1, 378 pages (hardcover), December 1991
Individual mem. $40, List price $66, Institutional mem. $53 Your ordering code is DIMACS/6NA

All prices subject to change. Free shipment by surface: for air delivery, please add $6.50 per title. *Prepayment required.* **Order from:** American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS in the continental U.S. and Canada to charge with VISA or MasterCard. Please add 7% GST to all orders totalling over $40 being shipped to Canada.

1992 Summer Research Institute

Quadratic forms and division algebras: Connections with algebraic K-theory and algebraic geometry
University of California, Santa Barbara, July 6–24

The fortieth Summer Research Institute sponsored by the American Mathematical Society will be devoted to *Quadratic forms and division algebras: Connections with algebraic K-theory and algebraic geometry* and will take place at the University of California, Santa Barbara. Members of the Organizing Committee are: **Richard Elman**, University of California, Los Angeles; **Burton I. Fein**, Oregon State University; **William Jacob** (co-chair), University of California, Santa Barbara; **T.-Y. Lam**, University of California, Berkeley; **Wayne Raskind**, University of Arizona; **Alex Rosenberg** (co-chair), University of California, Santa Barbara; **David Saltman**, University of Texas at Austin; and **Adrian Wadsworth**, University of California, San Diego.

It is anticipated that the institute will be partially supported by a grant from the National Science Foundation. Proceedings of the institute will be published in the AMS series *Proceedings of Symposia in Pure Mathematics*.

This topic was selected by the 1991 AMS Committee on Summer Institutes and Special Symposia whose members at the time were: **Lawrence Craig Evens**, **Nicholas Katz** (chair), **Barbara Lee Keyfitz**, **Brian Parshall**, **Francois Treves**, and **Edward Witten**.

During the 1980's the closely related subjects of the algebraic theory of quadratic forms and the theory of finite-dimensional division algebras benefited greatly from developments in algebraic K-theory and algebraic geometry. The organizers of the institute are particularly interested in stimulating further progress along these lines by having two special lecture series, one devoted to algebraic K-theory and the other to algebraic geometry. In addition there will be research lectures on the two principal themes; quadratic forms and division algebras.

The Organizing Committee plans to invite six distinguished lecturers, each to give a one-week series of lectures either on *Algebraic K-theory* or *Algebraic geometry* and their connections to the institute topics. Two of these lectures will be given each morning during the three-week duration. These lectures will focus on the hows and whys of these tools and should be accessible to advanced graduate students. The exact topics are not yet known and will be decided by the invited lecturers. Possible topics include: etale cohomology, K-theory of quadric hypersurfaces and twisted forms of linear algebraic groups, generalized class field theories, and Witt groups of schemes. A tentative list of speakers who have agreed to be principal lecturers includes J.-L. Colliot-Thélène, A. S. Merkurjev, Wayne Raskind, A. A. Suslin, David Saltman, and R. Swan.

The first week of the institute will have quadratic forms emphasis, the third week will have division algebra emphasis, and the second week will emphasize both with the hope of stimulating interaction. During the afternoons the institute will have specialty lectures. These lectures will be on current research in the algebraic theory of quadratic forms, the theory of finite-dimensional division algebras, and related topics. Since it is likely that some participants will not attend the institute for the full three-week period, one week will be scheduled with quadratic forms emphasis and another with division algebra emphasis. However, it is planned to have these topics mixed as much as possible in order to encourage interaction. In addition to the research lectures, small seminars will be organized. There is particular interest in encouraging the participation of advanced graduate students, and seminars will be organized to help these students absorb the content of the lectures. Faculty with advanced graduate students should write to William Jacob, Department of Mathematics, University of California, Santa Barbara, Santa Barbara CA 93106, regarding support for these students. Questions regarding the scientific program should be directed to William Jacob at the above address.

The institute will be held on the campus of the University of California, Santa Barbara. Participants will be housed in university apartments which are considerably more comfortable than traditional dormitory housing. The lecture halls, beach, restaurants, and grocery stores are all located within a 20-minute walk from the apartments. Downtown Santa Barbara is accessible by express bus service from the campus. Persons with severe mobility problems should contact Professor Jacob at the above address as soon as possible since housing adjacent to the lecture halls is extremely limited. All facilities will be accessible to the handicapped.

Information on housing, dining, travel, and the local area will be sent to invited participants in the spring. Each participant will pay a registration fee and a social fee to cover the costs of social events scheduled during the institute.

Those interested in receiving an invitation to participate in the institute should send the following information to Summer Institute Conference Coordinator, American Mathematical Society, Post Office Box 6887, Providence, RI 02940, **prior to April 1, 1992** or through electronic mail to WSD@MATH.AMS.COM.

Please type or print the following:
1. Full name
2. Mailing address

3. Telephone number and area code for office and home, FAX number, and electronic mail address
4. Which week or weeks you wish to attend
5. Your scientific background relevant to the institute topic
6. Financial assistance requested
7. Indicate if support is not required, and whether interested in attending even if support is not offered.

Requests for invitations will be forwarded to the Organizing Committee for consideration up to the deadline of April 1. All applicants will receive formal invitations. Participants receiving financial support will be notified beginning in mid-May.

1992 Summer Seminar in Applied Mathematics

Exploiting Symmetry in Applied and Numerical Analysis

Colorado State University, July 26 – August 1

The twenty-second AMS-SIAM Summer Seminar in Applied Mathematics will be held July 26 – August 1, 1992 at Colorado State University, Fort Collins, Colorado. The seminar will be sponsored by the American Mathematical Society, the Society for Industrial and Applied Mathematics, and the Department of Mathematics at Colorado State University. It is anticipated that it will be 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.

The aim of the conference is to provide a wide-ranging survey of the exploitation of symmetry in applied and numerical analysis. The seminar will have both an entry level summer school component intended for young researchers and a frontier level research aspect. A number of the anticipated participants will be experts from foreign countries.

A purpose of the seminar is to stimulate interaction between aspects of Applied Mathematics (e.g., PDEs, integral equations, bifurcation), Numerical Mathematics (e.g., numerical linear algebra, boundary and finite element methods), Pure Mathematics (e.g., representation theory of groups), and Classical Physics (e.g., Taylor and Bénard problems).

The tentative list of invited speakers includes **William F. Ames**, Georgia Institute of Technology; **Dieter Armbruster**, Arizona State University; **George W. Bluman**, University of British Columbia; **Alain Bossavit**, Electricité de France; **Fritz H. Busse**, University of Bayreuth, Germany; **Pascal Chossat**, University of Nice, France; **Peter A. Clarkson**, University of Exeter; **John David Crawford**, University of Pittsburgh; **Gerhard Dangelmayr**, University of Tübingen, Germany; **Michael Dellnitz**, University of Houston; **Timothy J. Healey**, Cornell University; **Henry Hermes**, University of Colorado; **Darryl D. Holm**, Los Alamos National Laboratories; **Gérard Iooss**, University of Nice, France; **Edgar Knobloch**, University of California, Berkeley; **P. S. Krishnaprasad**, University of Maryland, College Park; **Jan Mandel**, University of Colorado, Denver; **Ian Melbourne**, University of Houston; **Hans-Detlef Mittelmann**, Arizona State University; **K. Murota**, University of Tokyo; **Heinz-Otto Peitgen**, University of Bremen, Germany; **Tudor Ratiu**, University of California, Santa Cruz; **Werner C. Rheinboldt**, University of Pittsburgh; **Duane Sather**, University of Colorado; **David Sattinger**, University of Minnesota; **Jürgen Scheurle**, University of Hamburg, Germany; **André Vanderbauwhede**, University of Ghent, Belgium; **Bodo Werner**, University of Hamburg, Germany.

The Organizing Committee consists of **Martin Golubitsky**, University of Houston; **Klaus W. Kirchgässner**, University of Stuttgart, Germany; **Peter J. Olver**, University of Minnesota; and the local organizers **Eugene L. Allgower** (Co-chairman), **Kurt Georg** (Co-chairman), and **Rick Miranda** (Co-chairman), Colorado State University.

Those interested in attending the Seminar should send the following information to Donna Salter, Conference Coordinator, American Mathematical Society, P.O. Box 6887, Providence, R.I. 02940, email: DLS@MATH.AMS.COM, **before May 6, 1992**. Please type or print the following:

1. Full name;
2. Mailing address;
3. Telephone number and area code for office and home;
4. email address if available;
5. Anticipated arrival and departure dates;
6. Your scientific background relevant to the topic of the seminar;
7. 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.

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.

Summer Meeting of the Canadian Mathematical Society June 12–14, 1992

Tentative Program

The Canadian Mathematical Society (CMS) and York University cordially invite all mathematicians to the 1992 Summer Meeting of the Society in North York, Ontario.

Principal Speakers

The names and affiliations of the principal speakers and the tentative days and times they will talk are as follows:

Jonathan L. Alperin, University of Chicago, Friday, 9:00 a.m.;

Craig L. Huneke, Purdue University, Friday, 1:30 p.m.;

Saharon Shelah, Hebrew University, Saturday, 9:00 a.m.;

William B. Johnson, Texas A & M University, Sunday, 9:00 a.m.;

Persi W. Diaconis, Harvard University, Sunday, 1:30 p.m.

Jeffery-Williams Lecturer

The Jeffery-Williams Lecture will be given by **Israel M. Sigal**, University of Toronto, on Saturday, June 13, at 1:30 p.m.

Symposia

Special Sessions in five domains will take place with session organizers and invited speakers as follows:

Group representation theory, **P. Hoffman**, University of Waterloo, organizer; D. Benson, University of Oxford; J. Carlson, University of Georgia; G. James, Imperial College, London; A. Weiss, University of Alberta; G. Cliff, University of Alberta; V. P. Snaith, McMaster University; H. Ellers, McMaster University

Betti numbers in algebra, geometry, and topology, **R. Buchweitz**, University of Toronto, organizer; R. Lazarsfeld, University of California, Los Angeles; C. Voisin, University of Paris IX; E. G. Evans, Jr., University of Illinois, Urbana-Champaign; L. Avramov, Sofia; S. Halperin, University of Toronto; G. Carlsson, Princeton University.

Banach spaces, **N. Tomczak-Jaegermann**, University of Alberta, organizer; W. J. Davis, The Ohio State University, Columbus; P. Enflo, Kent State University; T. Figiel, Polish Academy of Science; N. Kalton, University of Missouri; L. Tzafriri, Hebrew University; J. Whitfeld, Lakehead University; V. Zizlev, University of Alberta.

Monte Carlo methods, **N. Madras**, York University, organizer; L. Devroye, McGill University; P. W. Glynn, Stanford University; M. Luby, University of California, Berkeley; M. C. Mackey, McGill University; A. Sinclair, University of Edinburgh and Rutgers University; A. D. Sokal, New York University; R. J. Tiobshirani, University of Toronto, G. S. Fishman, University of North Carolina, Chapel Hill.

Set theory, **J. Steprans**, York University, organizer; J. Baumgartner, Dartmouth University; M. Bell, University of Manitoba; M. Foremann, The Ohio State University, Columbus; R. Laver, University of Colorado, Boulder; A. Mekler, Simon Fraser University; A. Hajnal, Hungarian Academy of Science; P. Komjath, Eotros Lorand University, Budapest; E. Milner, University of Calgary; N. Saver, University of Calgary; S. Todorcevic, University of Colorado, Boulder.

Mathematics Education

There will be a session on *Mathematics education* with a principal speaker to be announced later.

Contributed Papers

Contributed papers of 15 minutes' duration are invited. Registration and abstract forms may be requested from the CMS office, 577 King Edward, Ottawa, Ontario, Canada, K1N 6N5, telephone (613) 564-2223, FAX (613) 789-1539. For inclusion in the May-June issue of *Notes of the Canadian Mathematical Society*, abstract forms (and registration fees) must be received by March 15. To be eligible to present a contributed paper, ALL abstract forms (and registration fees) must be received before April 15.

Stochastic Processes and their Applications

This conference, sponsored by the Committee on Stochastic Processes and the Bernoulli Society for Mathematical Statistics and Probability, will be held at York University immediately after the CMS conference, June 14–19, 1992. A discounted registration fee is available for those who attend both conferences. Further information may be obtained

from N. Madras, Department of Mathematics and Statistics, York University, 4700 Keele Street, North York, Ontario, Canada, M3J 1P3.

Dormitory Accomodations

Single and double rooms are available in air-conditioned dormitory residences with separate communal washrooms for men and women. The rates, which include breakfast, are $42.95 CDN per night for a single room and $71.90 CDN per night for a double room. Please note that these rates are in Canadian dollars. Reservation forms may be requested from the CMS office, 577 King Edward, Ottawa, Ontario, Canada K1N 6N5, telephone (613) 564-2223, FAX (613) 789-1539. Forms must be submitted **before May 15, 1992** to guarantee the availability of a room. For further information, contact Mr. Frank Villiva, Hospitality York, 4700 Keele Street, North York, Ontario, Canada M3J 1P3; Telephone (416) 736-5020, FAX: (416) 736-5531.

Hotel Accommodations

Small blocks of hotel rooms have been reserved at three hotels in the metropolitan Toronto area. York University can be reached in less than an hour from downtown by public transportation. However, it is not reasonable to use public transportation to reach York University from the other two hotels. Please contact the hotel directly if you wish to make a reservation. Be sure to make your reservations early and mention that you are attending the CMS meeting at York University to obtain the special rates quoted below (in Canadian dollars).

Novotel North York

3 Park Home Avenue, North York, Ontario, M2N 6L3, (located in downtown North York, near Yonge and Sheppard). Telephone: (416) 733-2929.

Single or double room: $85

Journey's End

66 Norfinch Drive, North York, Ontario M3N X1X, (located a short drive from the York University campus near Highway 400). Telephone: (416) 736-4700.

Single room: $59.88

Double room: $67.88

Novotel Toronto Centre

45 The Esplanade, Toronto, Ontario M5E 1W2, (located in downtown Toronto). Telephone: (416) 367-8900.

Single or double room: $119 (weekdays)
$ 99 (Friday, Saturday)

Transportation

York University is located in the northern part of Metropolitan Toronto southeast of the intersection of Keele Street and Steeles Avenue. It is just north of Highway 401 and just east of Highway 400. If you arrive by car, park in one of the nonreserved lots. Go directly to the check-in desk at Hospitality York, 1087 McLaughlin (College) if you have reserved dormitory accommodation or to Osgoode Hall for the conference itself.

To reach York University by public transportation, take the Yonge-University subway to the last stop at Wilson. From there take the 106 bus to York University.

If you arrive at the airport take a flat-rate taxi to York University. The cost should be about $30 CDN. Alternatively, take a Gray Coach bus ($6 CDN one way, $10 CDN round trip) to the Yorkdale subway station; take the subway one stop north to Wilson and the 106 bus to York University.

Registration Fees (in Canadian dollars)

	Before April 15	After April 15
CMS/AMS/MAA/BS* Members with grants	$125	$155
CMS/AMS/MAA/BS* Members without grants	60	90
Non-Members with grants	175	200
Non-Members without grants	85	115
Students/Retired Faculty	30	55
Education Session Only	50	65
One day fee	65	65

*BS=Bernoulli Society

Additional fees for those attending both the CMS Meeting and the Stochastic Processes Conference:

If attending both conferences in their entirety:		
Faculty with grants, add	$ 65	$ 90
Faculty without grants, add	90	115
Retired member, add	100	125
Retired nonmember, add	115	140
Student, add	25	50

If attending the whole of the Stochastic Processes Conference plus one day of the CMS meeting:		
Member of the Bernoulli Society, add	$100	$125
Nonmember of the Bernoulli Society, add	115	140

Further information: **S. O. Kochman**, Local Organizer, CMS Summer '92, Department of Mathematics and Statistics, York University, 4700 Keele Street, North York, Ontario M3J 1P3 Canada; telephone (416) 636-5250; FAX (416) 736-5735; email: CMS92@NEXUS.YORKU.CA.

Mathematical Sciences Meetings and Conferences

1991–1992. **Mittag-Leffler Institute Academic Program for 1991–1992: Combinatorics**, Djursholm, Sweden. (Apr. 1991, p. 359)

1991–1992. **1991-1992 Special Year on Automorphic Forms in Number Theory**, Centre de Recherches Mathématiques, Université de Montréal. (Dec. 1991, p. 1332)

1991–1992. **DIMACS Special Year: Graph Theory and Algorithms**, Center for Discrete Mathematics, Rutgers, The State University of New Jersey. (Oct. 1991, p. 1005)

1992

1992. **IMACS Symposium on Symbolic Computation in Engineering Design**, IDN, Lille, France. (Jul./Aug. 1990, p. 746)

1992. **IMACS International Conference on Computational Physics**, University of Colorado, Boulder, CO. (Oct. 1990, p. 1141)

Spring 1992. **International Conference on Finite Elements and Boundary Elements in Geophysics**, Monteray, CA. (Oct. 1990, p. 1141)

Spring 1992. **Third IMACS International Conference on Expert Systems in Numerical Computing**, Purdue University, West Lafayette, IN. (May/Jun. 1991, p. 475)

Spring 1992. **DIMACS Workshop on Expander Graphs: Theory and Applications**, Center for Discrete Mathematics, Rutgers, The State University of New Jersey, New Brunswick, NJ. (Oct. 1991, p. 1007)

March 1992

* 10–12. **The Lyon Conference—The Computer as a Partner: Person-Machine Interactions**, Lyon, France.

PROGRAM: The conference aims at making a review, through various applications, of the existing techniques in the field of Person/Machine communication, as well as of their mid-term evolution. The interfaces of the future, making use of speech, written natural language, image analysis and generation, gesture and touch, will be presented.

INFORMATION: S. Dubeauclard, Concord International, Inc., 1030 N. Glenhurst, Birmingham, MI 48009; 313-647-7833; email: 76370.752@compuserve.com.

13–14. **A Conference on Harmonic Analysis and Probability Theory**, Kansas State University, Manhattan, KS. (Feb. 1992, p. 139)

13–15. **Permian Basin Supercomputing Conference 1992**, University of Texas of the Permian Basin, Odessa, TX. (Dec. 1991, p. 1334)

THIS SECTION contains announcements of meetings and conferences of interest to some segment of the mathematical public, including *ad hoc*, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. (Information on meetings of the Society, and on meetings sponsored by the Society, will be found inside the front cover.)

AN ANNOUNCEMENT will be published in *Notices* if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second full announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

IN GENERAL, announcements of meetings and conferences held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of *Notices*, care of the American Mathematical Society in Providence.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

EFFECTIVE with the 1990 volume of *Notices*, the complete list of Mathematical Sciences Meetings and Conferences will be published only in the September issue. In all other issues, only meetings and conferences for the twelve-month period following the month of that issue will appear. As new information is received for meetings and conferences that will occur later than the twelve-month period, it will be announced at the end of the listing in the next possible issue. That information will not be repeated until the date of the meeting or conference falls within the twelve-month period.

14. **Midwest Group Theory Seminar**, University of Chicago, IL. (Jan. 1992, p. 47)

15–21. **Regelungstheorie**, Oberwolfach, Federal Republic of Germany. (Jan. 1991, p. 52)

19–20. **The Third Annual Ulam Math Conference**, Palm Beach Atlantic College, West Palm Beach, FL. (Feb. 1992, p. 140)

19–22. **1991-1992 Annual Meeting of the Association for Symbolic Logic**, Duke Univ., Durham, NC. (Dec. 1991, p. 1334)

20–21. **Central Section**, Southwest Missouri State University, Springfield, MO.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

20–21. **Eighth Auburn Miniconference on Real Analysis**, Auburn University, Auburn, AL. (Feb. 1992, p. 140)

21–27. **Workshop on Fluid Dynamics and Statistical Physics**, Institute for Advanced Study, Princeton, NJ. (Dec. 1991, p. 1334)

22–28. **Teichmüller-Theorie und Modulraume Riemannscher Flachen**, Oberwolfach, Federal Republic of Germany. (Jan. 1991, p. 52)

22–28. **Georgia Tech.-UAB International Conference on Differential Equations and Mathematical Physics**, Atlanta, GA. (Jul./Aug 1991, p. 644)

23–27. **Elliptic Boundary Value Problems**, Rostock, Federal Republic of Germany. (Dec. 1991, p. 1334)

23–April 10. **Representation of Lie Groups (Advanced Workshop)**, Trieste, Italy. (Dec. 1991, p. 1334)

24–26. **Data Compression Conference–DCC '92**, Snowbird, Utah. (Nov. 1991, p. 1167)

24–28. **GAMM Annual Meeting**, Leipzig, Germany. (Sep. 1991, p. 836)

24–28. **Algebraic Groups and Their Representations**, University of California, Los Angeles. (Oct. 1991, p. 1008)

25–28. **International Conference on Hamiltonian Dynamical Systems**, Univ. of Cincinnati, Cincinnati, OH. (Nov. 1991, p. 1167)

*26–27. **Preparing for the Twenty-first Century: Human Resources in Science and Technology**, Washington, DC.

PROGRAM: This is the ninth biennial symposium on human resources in science and technology, sponsored by the Commission on Professionals in Science and Technology (CPST, formerly the Scientific Manpower Commission). Experts will examine the complete picture of the future workforce, beginning from its education through its employment in all sectors: industry, academe, and government; the emerging foreign national issue; and the global workforce.

INVITED SPEAKERS: D. Allan Bromley, the President's Science Advisor; Erich Bloch, former director of the National Science Foundation; John Lyons, Director of the National Institute of Standards and Technology; Barbara Bergman, President of the American Association of University Professors; and immigration law expert, Charles C. Foster. Janet Halliwell, Chairman of the Science Council of Canada, will be the dinner speaker, and Dan Greenberg, Editor, *Science and Government Report*, will be a luncheon speaker.

INFORMATION: CPST, 1500 Massachusetts Ave, NW, Suite 831, Wahington, DC 20005, 202-223-6995.

*26–29. **JAMI Conference on Geometry and Quantum Field Theory**, Baltimore, MD.

CHAIRMEN: J. Bagger, R. Dijkgraaf, J. Morava.

CONFERENCE THEMES: 2-dimensional gravity, mirror symmetry, 2-dimensional string theory, solvable gauge theories, elliptic cohomology.

INFORMATION: JAMI Conference, Dept. of Math., The Johns Hopkins University, Baltimore, MD 21218; 410-516-8232 or 410-516-7409.

*27–28. **Eighth South-Eastern Analysis Meeting (SEAM VIII)**, University of Tennessee, Knoxville, TN. (Please note additional information to Sep. 1991, p. 836)

PRIMARY SPEAKERS: P. Jones (Yale U.), J. Agler (U. of California, San Diego), D. Khavinson (U. of Arkansas), D. Marshall (U. of Washington).

29–April 4. **Topologische Methoden in der Gruppentheorie**, Oberwolfach, Federal Republic of Germany. (Jan. 1991, p. 52)

29–April 5. **Sixth International Conference on Geometry**, University of Haifa, Israel (postponed from March 1991 because of the Gulf War). (Jul./Aug. 1991, p. 644)

30–31. **IMA International Conference on Mathematics in Industrial Maintenance**, Edinburgh, Scotland. (Nov. 1991, p. 1167)

30–April 2. **Thirty-fourth British Theoretical Mechanics Colloquium**, University of Keele, England. (Sep. 1991, p. 836)

30–April 3. **Workshop on Statistical Methods in Molecular Biology**, Mathematical Sciences Research Institute, Berkeley, CA. (Sep. 1991, p. 836)

April 1992

April 1992. **Eighth International Conference on Mathematical and Computer Modelling**, United States. (Sep. 1990, p. 939)

2–4. **Twenty-sixth Annual Spring Topology Conference**, University of North Carolina, Charlotte, NC. (Dec. 1991, p. 1334)

3–4. **1992 Illinois Number Theory Conference**, University of Illinois, Urbana, IL. (Nov. 1991, p. 1167)

3–4. **Sixteenth Annual Meeting of the Southeast-Atlantic Section of SIAM**, University of Alabama, Huntsville, AL. (Dec. 1991, p. 1334)

3–5. **Southeast Dynamical Systems Conference**, Raleigh, NC. (Dec. 1991, p. 1335)

*5–7. **The Development of the Foundations of Mathematics: A Symposium**, School of Theology, Boston University, Boston, MA.

CHAIRMEN: J. Hintikka and R.S. Cohen.
INVITED SPEAKERS: G. Boolos, W. Boos, B. Dreben, H. Edwards, P. Ehrlich, D. Follesdal, C. Hill, J. Hintikka, A. Kanamori, D. McCarty, G. Moore, J. von Plato, C. Smorynski, J. Webb, and J. Wolenski.
INFORMATION: Boston Colloquium for the Philosophy of Science, Center for Philosophy and History of Science, Boston University, Boston, MA 02215.

5–11. **Algebraische K-Theorie**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

5–11. **Informationstheorie**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1991, p. 644)

6–8. **Nineteenth Conference of the Standing Committee on Regional and Urban Statistics**, Prague, Czechoslovakia. (Dec. 1991, p. 1335)

6–10. **IMA Workshop on Linear Algebra for Signal Processing**, University of Minnesota, Minneapolis, MN. (Oct. 1990, p. 1141)

6–10. **Forty-fourth British Mathematical Colloquium**, University of Strathclyde, Glasgow, Scotland, UK. (Nov. 1991, p. 1167)

6–10. **Second International Conference on p-Adic Functional Analysis**, Universidad de Santiago, Santiago, Chile. (Dec. 1991, p. 1335)

6–10. **Complas III Third International Conference on Computational Plasticity, Fundamentals, and Applications**, Barcelona, Spain. (Dec. 1991, p. 1335)

7–8. **Tutorial on Polynomial Iterative Methods**, Denver, CO. (Dec. 1991, p. 1335)

7–10. **Twenty-third Annual Iranian Mathematics Conference**, Razi University, Bakhtaran, Iran. (Sep. 1991, p. 836)

7–10. **Statistics in Public Resources and Utilities, and in Care of the Environment (SPRUCE)**, Lisbon, Portugal. (Nov. 1991, p. 1167)

9–11. **Symplectic Topology**, University of Arkansas, Fayetteville, Arkansas. (Sep. 1991, p. 837)

9–14. **Copper Mountain Conference on Iterative Methods**, Copper Mountain, CO. (Dec. 1991, p. 1335)

10–12. **Structure and Representation Theory of Lie Algebras**, Yale University, New Haven, CT. (Feb. 1992, p. 140)

11–12. **Eastern Section**, Lehigh University, Bethlehem, PA.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Providence, RI 02940.

12–16. **Diophantine Approximation and Abelian Varieties**, Soesterberg, The Netherlands. (Dec. 1991, p. 1335)

12–18. **Mathematische Logik**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

13–17. **Workshop on Lie Groups, Ergodic Theory, and Geometry**, Mathematical Sciences Research Institute (MSRI), Berkeley, CA. (May/Jun. 1991, p. 476)

13–17. **Titre a Préciser**, Marseille, France. (Dec. 1991, p. 1335)

18. **Sixth New England Statistics Symposium**, Bentley College, Waltham, MA. (Dec. 1991, p. 1335)

19–25. **Arbeitsgemeinschaft mit Aktuellem Thema**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

23–25. **Workshop on Classifications of Higher Dimensional Manifolds**, Knoxville, TN. (Jan. 1992, p. 48)

26–28. **Conference on Applied Statistics in Agriculture**, Kansas State University, Man-

hattan, KS. (Nov. 1991, p. 1167)

26–29. **Scalable High Performance Computing Conference "SHPCC '92"**, Williamsburg, VA. (Dec. 1991, p. 1335)

26–May 2. **Gruppentheorie**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

27–31. **Titre a Préciser**, Marseille, France. (Dec. 1991, p. 1336)

30–May 1. **Twenty-third Annual Pittsburgh Conference on Modeling and Simulation**, University of Pittsburgh, PA. (Jul./Aug. 1991, p. 644)

May 1992

May 1992. **Conference on Classification of Algebraic Varieties**, L'Aquila, Italy. (Apr. 1991, p. 366)

1. **Mathematical Modeling in Biology**, SUNY at Stony Brook, NY. (Jan. 1992, p. 48)

* 1–3. **The Mathematical Legacy of Wilhelm Magnus: Groups, Geometry, and Special Functions**, Polytechnic University, NY.

PROGRAM: This conference will explore Magnus' pioneering work and its many offshoots in group theory, geometry and topology, special functions of mathematical physics and the interconnections of these fields. Recent works suggestive of successful future investigations will receive special emphasis.
SPONSORS: American Mathematical Society, Courant Institute of Mathematical Sciences (NYU), Merrill Lynch & Co., Metropolitan Life Insurance Company, Polytechnic University, and Teleport Communications Group.
ORGANIZING COMMITTEE: W. Abikoff, G. Baumslag, J. Birman, B. Chandler, B. Fine, G. Francis, K. Kuiken (co-chair), L. Sibner (co-chair).
INVITED SPEAKERS: R. Askey (Madison), G. Baumslag (NY), J. Birman (NY), J. Cannon (Provo), B. Fine (Fairfield), E. Formanek (University Park), W. Harvey (London), H. Hochstadt (NY), B. Maskit (Stony Brook), H. McKean (NY), J. Moody (London), P. Schupp (Urbana), H. Short (NY).
CALL FOR PAPERS: A refereed Conference Proceedings will be published by the AMS. This volume will include papers by speakers as well as other papers appropriate for this volume. Papers should be submitted near the time of the conference.
INFORMATION: K. Kuiken (Magnus Conference), Polytechnic University, 333 Jay St., Brooklyn, NY 11201; 718-260-3850; Fax: 718-260-3136; email: kkuiken@vm.poly.edu or email: kkuiken@polyvm.bitnet.

1–5. **Topology and its Connections to Geometry and Modular Representation Theory**, Northwestern University, Evanston, IL. (Dec. 1991, p. 1336)

2–3. **Miniconference on C*-algebras and Related Topics**, University of Maryland, College Park, MD. (Feb. 1992, p. 141)

3–9. **Wavelett (Signalverarbeitung)**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

3–14. **Evolutionary Stochastic Systems: Theory and Applications to Physics and Biology**, Katsively, Crimea, Ukraine (USSR). (Dec. 1991, p. 1336)

4–6. **1992 ACM Symposium on the Theory of Computing**, Victoria, British Columbia, Canada. (Oct. 1991, p. 1009)

4–6. **1992 IEEE Symposium on Research in Security and Privacy**, Oakland, CA. (Nov. 1991, p. 1168)

10–16. **Geschichte der Mathematik**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

11–13. **Fourth SIAM Conference on Optimization**, Chicago, IL. (Feb. 1991, p. 146)

11–15. **IUTAM Symposium on Inverse Problems in Engineering Mechanics**, Tokyo, Japan. (Sep. 1991, p. 837)

11–15. **Rencontre Franco-Russe de Géometrie**, Marseille, France. (Dec. 1991, p. 1336)

13–15. **Fifth Annual IMSL User Group North America**, Chicago, IL. (Feb. 1992, p. 141)

14–16. **Workshop on Cohomological Dimension Theory**, Knoxville, TN. (Jan. 1992, p. 48)

17–23. **Quadratische Formen**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

18–20. **Parallel CFD '92: Implementations and Results Using Parallel Computers**, Rutgers University, New Brunswick, NJ. (Feb. 1992, p. 141)

18–22. **Eighth International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits: NASECODE VIII**, City Club, Vienna, Austria. (Nov. 1991, p. 1168)

18–22. **Algebren en Théorie des Nombres**, Marseille, France. (Dec. 1991, p. 1336)

18–23. **Second European Conference on Computer Vision**, Santa Margherita Ligure, Italy. (Jul./Aug. 1991, p. 645)

18–23. **Low-Dimensional Topology**, Knoxville, TN. (Oct. 1991, p. 1009)

20–June 5. **Workshop on Automorphic Forms and L-functions**, Institute for Advanced Studies, Hebrew Univ. of Jerusalem, Israel. (Nov. 1991, p. 1168)

21–22. **Fourteenth Symposium on Mathematical Programming with Data Perturbations**, George Washington University, Washington, DC. (Jan. 1992, p. 48)

* 21–23. **UCCS Conference on Mathematical Aspects of Computer Vision**, University of Colorado at Colorado Springs, Colorado Springs, CO.

PROGRAM: The focus will be on those aspects of computer vision with mathematical content, broadly interpreted. This includes applications of probability to development and analysis of algorithms, complexity of algorithms, variational approaches to image segmentation, statistical models of images, geometric interpretations of edge detection, etc.
PRINCIPLE SPEAKERS: W. Eric L. Grimson (MIT) and J. Shah (Northeastern).
CALL FOR PAPERS: Contributed talks are solicited. Send an abstract, one page or less, to the address below by April 1, 1992.
INFORMATION: R. Carlson or K. Phillips, Dept. of Math., Univ. of Colorado at Colorado Springs, Colorado Springs, CO 80933; email: carlson@vision.uccs.edu or keith@pyramid.uccs.edu.

24–28. **Eurocrypt '92–A Workshop on the Theory and Applications of Cryptographic Techniques**, Balatonfüred, Hungary. (Jan. 1992, p. 48)

24–30. **Kommutative Algebra und Algebraische Geometrie**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 146)

25–28. **NATO Advanced Research Workshop: Asymptotic-Induced Numerical Methods for PDE's, Critical Parameters, and Domain Decomposition**, Beaune, France. (Sep. 1991, p. 837)

25–29. **Endoscopie Automorphe**, Marseille, France. (Dec. 1991, p. 1336)

25–June 5. **School on Dynamical Systems**, International Centre for Theoretical Physics, Trieste, Italy. (Jan. 1992, p. 49)

26–28. **First Iranian Statistics Conference**, Isfahan University of Technology, Isfahan, Iran. (Jan. 1992, p. 49)

27–31. **IMACS International Conference on Finite Elements and Boundary Elements in Geosciences**, Florida State University, Tallahassee, FL. (Jan. 1992, p. 49)

27–31. **NSF-CBMS Conference on Weak Turbulence and Nonlinear Waves with Applications in Oceanography and Geophysics**, Case Western Reserve University, Cleveland, OH. (Jan. 1992, p. 49)

28–30. **ICCI '92–Fourth International Conference on Computing and Information**, Toronto, Canada. (Oct. 1991, p. 1009)

29–30. **Midwest-Great Plains Workshop in Commutative Algebra-IV**, University of Kansas, Lawrence, KS. (Jan. 1992, p. 49)

29–31. **Twenty-first International Symposium on Multi-Valued Logic**, Sendai 980,

Japan. (Jan. 1990, p. 62)

30–June 2. **Annual Meeting of the Statistical Society of Canada**, Edmonton, Alberta, Canada. (Feb. 1992, p. 142)

31–June 6. **Singularitaten**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

31–June 6. **Free Resolutions in Algebraic Geometry and Representation Theory**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

31–June 14. **Summer Workshop: Calculus, Computers, Concepts, and Cooperative Learning**, Purdue University, West Lafayette, IN. (Dec. 1991, p. 1336)

June 1992

June 1992. **IMACS Symposium on Numerical Computing and Mathematical Modelling**, Bangalore, India. (Oct. 1990, p. 1141)

June 1992. **Continuum Models for the Microstructure of Crystals**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Oct. 1991, p. 1009)

1–5. **Seventh International Conference on Graph Theory, Combinatorics, Algorithms, and Applications**, Western Michigan University, Kalamazoo, MI. (May/Jun. 1991, p. 476)

1–5. **IMA Workshop on Linear Algebra for Control Theory**, University of Minnesota, Minneapolis, MN. (Oct. 1990, p. 1141)

1–5. **Third International Conference on Mathematical Population Dynamics**, University of Pau, France. (Dec. 1991, p. 1336)

1–5. **Calcul Formel et Équations Différentielles**, Marseille, France. (Jan. 1992, p. 49)

1–5. **NSF-CBMS Regional Research Conferences in the Mathematical Sciences: Number Theory and Dynamical Systems**, California State University, Fresno, CA. (Jan. 1992, p. 49)

4–6. **AT LAST: An NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools**, West Valley College, Saratoga, CA. (Feb. 1992, p. 142)

7–11. **International Joint Conference on Neural Networks "IJCNN '92"**, Baltimore, MD. (Dec. 1991, p. 1337)

7–13. **Computational Group Theory**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

8–11. **Sixth SIAM Conference on Discrete Mathematics**, University of British Columbia, Vancouver, Canada. (May/Jun. 1991, p. 476)

8–12. **Séminaire Sud-Rhodanien de Géométrie**, Marseille, France. (Jan. 1992, p. 49)

8–12. **NSF Undergraduate Faculty Enhancement Workshop: Algorithmic Number Theory**, California State University, Fresno, CA. (Jan. 1992, p. 50)

8–13. **Zero-dimensional Schemes**, Ravello, Italy. (Sep. 1991, p. 837)

8–13. **Continuum Models for the Microstructure of Crystals**, Edinburgh, Scotland. (Jan. 1992, p. 50)

8–19. **Dirichlet Forms**, Villa Monastero, Varenna, Italy. (Dec. 1991, p. 1337)

8–19. **Workshop on Dynamical Systems**, International Centre for Theoretical Physics, Trieste, Italy. (Jan. 1992, p. 50)

9–11. **International Conference on Art and Mathematics**, SUNY Albany, NY. (Feb. 1992, p. 142)

10–16. **Geometric Topology Workshop**, Technion, Haifa, Israel. (Nov. 1991, p. 1168)

11–13. **AT LAST: An NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools**, Auburn University, Auburn, AL. (Feb. 1992, p. 142)

* 11–13. **Ninth Annual Western Workshop in Geometric Topology**, Colorado College, Colorado Springs, CO.

ORGANIZERS: R. Ancel, C. Guilbault (U. Wisconsin-Milwaukee), D. Garity (Oregon State U.), J. Henderson, F. Tinsley (Colorado College).
INVITED SPEAKER: Mladen Bestvina (UCLA).
INFORMATION: J. Henderson (email: jhenderson@cc.colorado.edu) or F. Tinsley (ftinsley@cc.colorado.edu), Dept. of Math., Colorado College, Colorado Springs, CO 80903.

* 11–13. **Logical Methods in Mathematics and Computer Science**, Cornell University, Ithaca, NY.

PROGRAM: A symposium held in honor of A. Nerode's 60th birthday.
INVITED SPEAKERS: U. Hartmanis, D. Kozen, V. Lifschitz, G. Metakides, J. Remmel, G. Sacks, D. Scott, R. Soare.
INFORMATION: R. Shore, Dpet. of Math., White Hall, Cornell U., Ithaca, NY 14835.

12–14. **Canadian Mathematical Society Summer Meeting**, York University, North York, Ontario, Canada. (Nov. 1990, p. 1289)

12–20. **D-moduli and Representation Theory**, Ca' Foscari, Venezia, Italy. (Dec. 1991, p. 1337)

13–16. **Conference in Geometric Group Theory**, Ohio State University, Columbus, OH. (Nov. 1991, p. 1168)

* 13–18. **Inverse Problems in Engineering: Theory and Practice**, Palm Coast, FL.

CHAIRMEN: Chair–N. Zabaras, Cornell U., Tel: 517-355-8487; Fax: 517-353-1758; Co-chairs–K.A. Woodbury, U. of Alabama and M. Raymond, Inst. National Des Sciences, France.
SPONSOR: Engineering Foundation, 345 E. 47th St., New York, NY 10017; tel: 212-705-7835; Fax: 212-705-7441.

* 14–17. **Third Symposium on "Chaotic Dynamical Systems"**, Conference Center "Woudschoten" (near Utrecht) the Netherlands.

INVITED LECTURERS: **Series of 3 lectures**: J.-P. Eckmann (U. Geneve), F.C. Moon (Cornell U., not yet confirmed), F. Takens (U. Groningen), J.A. Yorke (U. of Maryland). The purpose of these lectures is to give an introduction of several developments in the field of dynamical systems for a broad audience. Each of these lectures is either an overview or deals with current research. **1 lecture**: H.W. Broer (U. Groningen), J.M. Grandmont (CEPREMAP, Paris), R.M. MacKay (U. Warwick), R.M. May (U. Oxford), S.J. van Strien (U. Delft), C. Tresser (IBM Yorktown Heights), F. Verhulst (U. Utrecht). The purpose of these lectures is either to present (new) developments in the current research for a broad audience or to present (new) developments in the current research for a more specialized audience.
PARALLEL SESSIONS: The purpose of 3 parallel sessions is twofold: 1) several participants may have the opportunity to present (a part of) their current work (25 minutes), and 2) some invited lecturers may present a lecture for a more specialized audience (1 hr.). Each session will have a theme (e.g. one-dimensional maps, ODEs, two- and higher-dimensional diffeomorphisms, applications in physics, applications in biology, applications in economics).
INFORMATION: H.E. Nusse, Rijksuniversiteit Groningen, Faculteit der Economische Wetenschappen, WSN-gebouw, Postbus 800, NL-9700 AV Groningen, The Netherlands.

14–20. **Fifth International Symposium on Statistical Decision Theory and Related Topics**, Purdue University, West Lafayette, IN. (Sep. 1990, p. 938)

14–20. **Freiformkurven und Freiformflachen**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

15–18. **Wave Phenomena II: Modern Theory and Applications**, Edmonton, Alberta, Canada. (Nov. 1991, p. 1169)

15–18. **Computer Vision and Pattern Recognition**, Champaign, IL. (Dec. 1991, p. 1337)

15–19. **Twenty-first International Conference on Stochastic Processes and their Applications**, Toronto, Canada. (May/Jun. 1990, p. 613)

15–19. **Fourth Conference on Formal**

Power Series and Algebraic Combinatorics, Université du Quebec a Montréal. (Sep. 1991, p. 837)

15–19. **Sixth International Conference on Domain Decomposition Methods in Science and Engineering**, Como, Italy. (Nov. 1991, p. 1169)

15–19. **Tire a Préciser**, Marseille, France. (Jan. 1992, p. 50)

* 15–20. **International Conference and Summer School on the Theory and Applications of Dynamical Systems**, Huddinge (Stockholm), Sweden.

PROGRAM: The primary focus of this combined summer school and conference will be the theory of dynamical systems, in particular stability theory, unstable manifolds, criteria of chaotic behavior and non-well-posed problems. Applications will include neural network dynamics and dynamics of membranes.
ORGANIZER: S.I. Andersson, Chalmers Science Park.
CALL FOR PAPERS: Two copies of a detailed abstract should be sent to the organizer by May 15, 1992.
INFORMATION: S.I. Andersson, Chalmers Science Park, S-412 88 Götoberg, Sweden; tel: +46 31 724284; Fax: +46 31 724240.

* 15–20. **Fourier Analysis and Partial Differential Equations**, Miraflores de la Sierra, near Madrid, Spain.

PROGRAM: Main courses of lectures will be given by G. Weiss, M. Christ, S. Chanillo, and T. Wolff, in the style of the previous "El Escorial" seminars of 1979, 1983, and 1987.
INFORMATION: Organizing Committee, 1992 Miraflores de la Sierra Fourier Analysis and PDE Conference, Dept. de Math., Univ. Autonoma de madrid, 28049 Madrid, Spain or J. Alvarez, Las Cruces, New Mexico.

15–27. **Nonequilibrium problems in many-particle systems**, Montecatini Terme, Italy. (Dec. 1991, p. 1337)

16–18. **1992 IFAC/IFIP/IMACS International Symposium on Artificial Intelligence in Real-Time Control**, Delph University of Technology, Delph, The Netherlands. (Jan. 1992, p. 50)

17–20. **Fourth International Conference on Computers and Learning, ICCAL '92**, Acadia University, Nova Scotia, Canada. (Feb. 1991, p. 147)

17–20. **Second Geoffrey J. Butler Memorial Conference on Differential Equations and Population Biology**, University of Alberta, Edmonton, Alberta, Canada. (Feb. 1992, p. 143)

18–20. **Eighteenth International Workshop on Graph-Theoretic Concepts in Computer Science "WG '92"**, Wiesbaden-Naurod, Federal Republic of Germany. (Jan. 1992, p. 50)

18–20. **Problem Solving Across the Curriculum**, Wells College, Aurora, NY. (Jan. 1992, p. 50)

18–20. **AT LAST: An NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools**, University of Wisconsin, Madison, WI. (Feb. 1992, p. 143)

* 18–20. **Eighth Summer Conference on General Topology and Applications**, Queens College, CUNY, New York City.

PRINCIPLE SPEAKERS: G. Bachman, Polytechnic Institute of NY; H. Priestley, U. of Oxford; D. Shakhmatov, Moscow State U.; J. Baumgartner, Dartmouth College; G.M. Reed, U. of Oxford; J. van Mill, Free Univ., Amsterdam.
CALL FOR PAPERS: Participants are invited to present shorter talks (approximately 20-25 minutes) on topics related to general topology and its applications. Abstracts should be 7.5 inches by 5 inches, with at most 4 lines per inch to be received by May 1, 1992.
INFORMATION: For fees, photo-ready abstracts, general: G. Itzkowitz, Queens College, Flushing, NY 11367; 718-380-1832; Fax: 718-997-5566; or TEX abstracts only: R. Kopperman, City College of NY, New York, NY 10031; 914-359-1444; Fax: 212-650-6970; mathrdk@ccnyvme.bitnet; or S. Hechler, Queens College, Flushing, NY 11367; 516-462-5509; Fax: 718-997-5566; hechler@qcvax.bitnet.

19–23. **International Conference on Complex Analysis**, Nankai Institute of Mathematics, Tianjin, China. (Feb. 1992, p. 143)

21–27. **Porous Media**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

21–July 10. **Summer Geometry Institute**, Park City, Utah. (Nov. 1991, p. 1169)

22–24. **Seventh IMACS International Conference on Computer Methods for Partial Differential Equations**, Rutgers University, New Brunswick, NJ. (Dec. 1991, p. 1337)

22–25. **Seventh Annual IEEE Symposium on Logic in Computer Science**, Santa Cruz, CA. (Sep. 1991, p. 838)

22–25. **Seventh Annual Conference on Structure in Complexity Theory**, Boston University, Boston, MA. (Nov. 1991, p. 1169)

22–26. **Fifth International Meeting on Statistical Climatology (5IMSC)**, Toronto, Canada. (Nov. 1991, p. 1169)

22–26. **Twelfth Conference on Probability and Statistics in the Atmospheric Sciences**, Toronto, Canada. (Nov. 1991, p. 1169)

22–26. **The Twelfth Dundee Conference on Ordinary and Partial Differential Equations**, Dundee, Scotland. (Nov. 1991, p. 1170)

22–26. **International Conference on Spectral and High Order Methods**, Montpellier, France. (Jan. 1992, p. 50)

22–26. **Convergences en Analyse Multivoque et Optimisation**, Marseille, France. (Jan. 1992, p. 50)

22–26. **International Conference on Nonlinear Evolution Problems**, Rome, Italy. (Jan. 1992, p. 50)

* 22–26. **Convergences en Analyse Multivoque et Unilatérale**, CIRM, Luminy, France.

ORGANIZERS: H. Attouch (U. de Montpellier) and M. Théra (U. de Limoges).
CONFERENCE TOPICS: Set convergence (Paileve-Kuratowski, Mosco, Hausdorff and bounded Hausdorff, slice ...), Γ-convergence of functions (epiconvergence, epi-hypo convergence, ...), graph-convergence of operators, hyperspace topologies, applications to approximation, perturbation, sensitivity analysis.
PLENARY TALKS: E. Balder (Utrecht), G. Beer (Los Angeles), A. Cellina (Trieste), B. Cornet (Paris I), E. de Giorgi (Pisa), U. Mosco (Roma), S.M. Robinson (Madison), R.T. Rockafellar (Seattle), R.J.-B. Wets (Davis).
INFORMATION: M. Thera, Universite de Limoges, Dept. de Math., 123, Avenue Albert Thomas, 87060 LIMOGES Cedex France.

23–26. **Homotopy Theory**, Sorrento, Italy. (Jul./Aug. 1991, p. 645)

23–27. **Workshop on Computational Geometry**, Turin, Italy. (Dec. 1991, p. 1338)

25–27. **AT LAST: An NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools**, University of Wyoming, Laramie, WY. (Feb. 1992, p. 143)

28–July 4. **Hyperbolic Systems of Conservation Laws**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

* 29–30. **International Conference on the Development of Mathematics from 1900 to 1950**, Luxembourg. (Please note additional information to Sep. 1991, p. 838)

PROGRAM: The conference aims to trace the main accomplishments in mathematics during the first half of the 20th century and to stress the impact on present mathematics.
INVITED SPEAKERS: P.L.Butzer (RWTH Aachen), J.L Doob (U. of Illinois), G. Fichera (U. di Roma), I.M. Gelfand (Moscow Academy of Sciences, Rutgers U.), M. Guillaume (U. de Clermont-Ferrand), W. Hayman (U. of York), C. Houzel (U. de Paris-Nord), J.-P. Kahane (U. de Paris-Sud), A. Lichnerowicz (College de France), L. Nirenberg (New York U.), J. Tits (College de France).

29–July 1. **Joint Meeting with the London Mathematical Society**, Cambridge, England.

INFORMATION: H. Daly, American Mathematical Society, Post Office Box 6887, Providence, Rhode Island 02940.

29–July 3. **International Conference on K-Theory**, Strasbourg, France. (Dec. 1991, p. 1338)

29–July 3. **Workshop on Data Analysis and Robustness**, Ascona, Switzerland. (Jan. 1992, p. 51)

29–July 3. **Greco Calcul Formel**, Marseille, France. (Jan. 1992, p. 51)

29–July 5. **Nineteenth International Colloquium on "Group Theoretical Methods in Physics"**, Salamance, Spain. (May/Jun. 1991, p. 476)

July 1992

1–4. **Algèbres d'Operateurs 1992 (a satellite conference of the European Congress of Mathematics)**, University of Orléans, France. (Jan. 1992, p. 51)

1–10. **Stochastic Analysis Workshop of Guadeloupe-Silivri**, Pointe-à-Pitre, France. (Jul./Aug. 1991, p. 645)

5–11. **Mathematische Modellierung und Simulation Elektrischer Schaltungen**, Oberwolfach, Germany. (Jul./Aug. 1991, p. 645)

5–August 1. **NSF Regional Geometry Institute: Computational Algebraic Geometry**, Amherst College, Amherst, MA. (Oct. 1991, p. 1010)

6–10. **European Congress of Mathematics**, Paris, France. (May/Jun. 1991, p. 476)

6–10. **Mathematical Conferences in Perth**, University of Western Australia. (Sep. 1991, p. 838)

6–10. **Eighteenth Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**, Perth, Western Australia. (Nov. 1991, p. 1170)

6–10. **Thirty-Sixth Annual Meeting of the Australian Mathematical Society**, Perth, Western Australia. (Nov. 1991, p. 1170)

6–10. **Strange Attractors and Knots**, Dynamical Systems Institute, Boston University, Boston, MA. (Feb. 1992, p. 144)

6–11. **RICA '92: RISC-LINZ Summer School in Computer Algebra 1992**, Johannes Kepler University, Linz, Austria. (Feb. 1992, p. 144)

6–17. **Conference on Contemporary Topics in Combinatorics**, University of Wyoming, Laramie, WY. (Feb. 1992, p. 144)

6–31. **IMA Summer Program on Environmental Studies: Mathematical, Computational, and Statistical Analysis**, Institute for Mathematics and its Applications, University of Minnesota. (Sep. 1991, p. 838)

6–August 14. **Summer Program in Mathematical Physiology**, Mathematical Sciences Research Institute, Berkeley, CA. (Sep. 1991, p. 838)

*10–12. **Annual Meeting for the Australasian Association for Logic**, Australian National University, Canberra, Australia.

PROGRAM: The meeting will be in honor of the sixtieth birthday of R. Meyer.
CALL FOR PAPERS: Papers on or relating to any aspect of Meyer's work are particularly welcomed. Papers and abstracts (one page or less) should be submitted by May 25, 1992.
INFORMATION: Conference Secretary, J. Slaney, CSIR, Australian National University, P.O. Box 4, Canberra, 2601 Australia.

11–18. **St. Andrews Colloquium**, University of St. Andrews, Scotland. (Jul./Aug. 1991, p. 645)

12–16. **Dynamics of Annulus Maps**, Dynamical Systems Institute, Boston University, Boston, MA. (Feb. 1992, p. 144)

12–17. **International Colloquium on Automata, Languages and Programming**, Vienna, Austria. (Jul./Aug. 1991, p. 645)

12–18. **Arithmetic Algebraic Geometry**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

*13–15. **Third Annual Göttingen Workshop on the History of Modern Mathematics**, Mathematischen Institut der Georg-August-Universität Göttingen.

INFORMATION: D. Rowe, Math. Dept., Pace U., Pleasantville, NY 10560; Fax: 914-773-3541; H. Becker, Dipl. Math., H. Rohlfing, Niedersächsische Staats- und Universitätsbibliothek, Prinzenstr. 1, D-3400 Göttingen; Fax: (0551)-395384.

13–17. **Titre a Préciser**, Marseille, France. (Jan. 1992, p. 51)

13–17. **RISC-LINZ Summer Course on Quantifier Elimination**, Johannes Kepler Universität, Linz, Austria. (Feb. 1992, p. 144)

13–24. **SMS-NATO ASI: Bifurcations and Periodic Orbits of Vector Fields**, Univ. de Montréal, Montréal, Canada. (Dec. 1991, p. 1338)

13–31. **Miniworkshop on Nonlinearity and Chaos**, Trieste, Italy. (Jan. 1992, p. 51)

15–17. **Premieres Journees Marocaines de Mathematiques Appliquees**, Rabat, Maroc. (Jan. 1992, p. 51)

19–23. **Sixth ACM International Conference on Supercomputing**, Washington, DC. (Dec. 1991, p. 1338)

19–23. **Complexity and Computability over the Reals**, Dynamical Systems Institute, Boston University, Boston, MA. (Feb. 1992, p. 144)

19–24. **SIAM Annual Meeting (SIAM's 40th Anniversary)**, Los Angeles, CA. (Feb. 1991, p. 147)

19–24. **Neural and Stochastic Methods in Image and Signal Processing**, San Diego, CA. (Feb. 1992, p. 145)

19–25. **Lower-Dimensional Theories and Domain Decomposition Methods in Mechanics**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

19–25. **Applications of Nonstandard-Analysis to Analysis, Functional Analysis, and Probability Theory**, Heinrich Fabri-Institut der Universität Tübingen, Blaubeuren (Ulm), Federal Republic of Germany. (Jul./Aug. 1991, p. 645)

19–31. **SERC Numerical Analysis Summer School**, Lancaster University, Lancaster, England. (Dec. 1991, p. 1338)

20–24. **The Fifth International Conference on Fibonacci Numbers and their Applications**, University of St. Andrews, St. Andrews, Scotland. (May/Jun. 1991, p. 476)

20–24. **Second Symposium on Logical Foundations of Computer Science (SCFS '92)**, Tver University, Tver, USSR. (Dec. 1991, p. 1339)

20–24. **Titre a Préciser**, Marseille, France. (Jan. 1992, p. 51)

*20–24. **SIAM Fortieth Anniversary Meeting**, Los Angeles, CA.

ORGANIZER: J.H. Hyman, Los Alamos National Laboratory.
INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; Fax: 215-386-7999; meetings@siam.org.

20–26. **International Conference on Algebraic Geometry**, Université Paris-Sud. (Jan. 1992, p. 52)

21–25. **Rademacher Centenary Conference**, Pennsylvania State University, University Park, PA. (Jan. 1992, p. 52)

22–25. **AT LAST: An NSF-ILAS Project to Augment the Teaching of Linear Algebra through the use of Software Tools**, University of Maryland, College Park, MD. (Feb. 1992, p. 145)

*Last week of July. **The Ninth Latin American Symposium of Mathematical Logic**, Universidad Nacional del Sur, Bahia Blanca, Argentina.

INVITED SPEAKERS: (Tentative): H.J. Keisler, A. Blass, J. Baumgartner, R. Laver, W. Taylor, D. Pigozzi, D. Scott, A. Scedrov, M. Dickmann, J. Stern, P. Dehornoy, D. Mundici, A. Marcja, S. Fajardo, C. Montenegro, H. Judah, R. Lewin, M. Marshall, I. Mickenberg, M. Corrada, M.G. Schwarze, F. Miraglia, W. Carnielli,

L.P. de Alcantara, N.C.A. da Costa, A.M. Sette.

CALL FOR PAPERS: Four short courses will be offered just before the meeting on topics such as algebraic logic, nonstandard analysis, set theory, and categorical logic.

INFORMATION: C.A. Di Prisco, Inst. Venezolano de Investigaciones Cientificas, Dept. de Mat., Apartado 21827, Caracas 1020-A Venezuela; Fax: (58 2)471-3164.

26–30. **Dynamics, Competition, and Neural Networks**, Dynamical Systems Institute, Boston University, Boston, MA. (Feb. 1992, p. 145)

26–31. **Eighteenth International Symposium on Rarefied Gas Dynamics (RGD18)**, University of British Columbia, Vancouver, Canada. (May/Jun. 1991, p. 477)

26–August 1. **Variationsrechnung**, Oberwolfach, Germany. (Feb. 1991, p. 147)

26–August 1. **AMS-SIAM Summer Seminar on Exploiting Symmetry in Applied and Numerical Analysis**, Colorado State University, Fort Collins, CO.

INFORMATION: D.L. Salter, AMS, P.O. Box 6887, Providence, RI 02940.

27–29. **International Symposium on Symbolic and Algebraic Computation**, Berkeley, CA. (Jan. 1992, p. 52)

27–31. **Mathematical Physics of Disordered Systems**, Marseille, France. (Jan. 1992, p. 52)

27–31. **Algorithms for Approximation**, Cranfield Institute of Technology, Oxford. (Feb. 1992, p. 145)

27–August 1. **Workshop on Computational Linear Algebra in Algebraic and Related Problems**, Essen, Federal Republic of Germany. (Jan. 1992, p. 52)

30–August 1. **The State of Matter: Conference on Mathematical Physics, Celebrating the Sixtieth Birthday of E.H. Lieb.**, Copenhagen, Denmark. (Dec. 1991, p. 1339)

August 1992

August 1992. **The International Conference Lobachevsky and Modern Geometry devoted to the 200th Anniversary of Lobachevsky's birthday**, Kazan, USSR. (Feb. 1991, p. 147)

August 1992. **Kinetics of Phase Transitions**, International Centre for Mathematical Sciences, Edinburgh, Scotland. (Oct. 1991, p. 1010)

2–8. **Algebraische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

*3–6. **Conference on Artificial Intelligence and Symbolic Mathematical Computations**, Karlsruhe, Germany.

PURPOSE: This conference is intended to attract scientists actively engaged in research on the topics mentioned below. The theme is the use of methods and techniques from AI in the domain of the symbolic solution of mathematical problems. Innovations relating computational mathematics to AI are also welcomed. Any paper dealing with both AI methods and symbolic mathematical computations fits the scope of the conference.

INVITED LECTURES: M.C. Golumbic (Haifa, *Reasoning about time*); L. Kerschberg (Fairfax, VA, *Multistrategy reasoning for database query optimization*); J. Pfalzgraf (Linz, *Mathematical modeling in robotics*); P. Struss (Munich, *Qualitative modeling*).

CALL FOR PAPERS: Authors are invited to submit papers up to 12 pages written in English. Send four copies of a complete paper to: J.A. Campbell, Comp. Sci. Dept., Univ. College London, Gower St., London WC 1E 6BT, England; email: jac@cs.ucl.ac.uk.

INFORMATION: J. Calmet (email: kg02@dkauni2.bitnet) or I.A. Tjandra (kg05@dkauni2.bitnet); Univ. Karlsruhe, Fakultät für Informatik, Inst. für Algorithmen und Kognitive Systeme, Am Fasanengarten 5, Postfach 69 80, D-7500 Karlsruhe 1; Tel: 07 21/608-4208; Fax: 07 21/69 68 93.

3–7. **Sixth Workshop on Lie-Admissible Formulations**, Clearwater, FL. (Mar. 1991, p. 244)

3–7. **Fifth International Meeting of Statistics in the Basque Country**, San Sebastin, Spain. (Jul./Aug. 1991, p. 646)

*3–7. **Second Meeting of the International Linear Algebra Society (ILAS)**, University of Lisbon, Portugal. (Please note additions and changes to Sep. 1991, p. 839)

PROGRAM: The program will include one hour invited talks and half hour invited talks on linear algebra and related topics. There will also be sessions for contributed talks.

CALL FOR PAPERS: Abstracts should be submitted by April 30, 1992.

INFORMATION: J. Dias da Silva. Dept. de Math. da Universidade de Lisboa, Rua Ernesto de Vasconcelos, Bloco C1, 1700 Lisboa, Portugal, email: mperdiga@ptearn.bitnet.

3–8. **Ninth Latin American Symposium on Mathematical Logic**, Bahia Blanca, Argentina. (Jan. 1992, p. 52)

3–14. **NATO Advanced Study Institute: Linear Algebra for Large Scale and Real-Time Applications**, Leuven, Belgium. (Feb. 1992, p. 145)

3–28. **IMA Summer Program for Graduate Students: Mathematical Modeling**, University of Minnesota, Minneapolis, MN. (Dec. 1991, p. 1339)

4–7. **Chaos and its Applications**, Trieste, Italy. (Jan. 1992, p. 52)

*9–12. **The Twelfth Annual International Conference on Critical Thinking and Educational Reform**, Sonoma State University, California.

PROGRAM: The Center invites proposals for sessions on any aspect of critical thinking. Our conference brings together over 1000 scholars and educators at all levels of education and from a wide variety of academic disciplines to discuss both the theory and the practice of critical thinking. The theme this year is Cultivating the Reasoning Mind: Teaching, Testing, Standards, and Assessment.

CALL FOR PAPERS: Proposals due by April 15, 1992.

INFORMATION: The Center for Critical Thinking and Moral Critique, Sonoma State University, Rohnert Park, CA 94928; 707-664-2940.

9–15. **Jordan-Algebren**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

*9–16. **1992 ASL European Summer Meeting (Logic Colloquium '92)**, Budapest, Hungary. (Please note addition to Dec. 1991, p. 1339)

INVITED SPEAKERS: S. Abramsky, H. Andréka, M. Foreman, D. Gabbay, M. Gitik, Yu. Gurevich, P. Komjath, H. Kotlarski, L. Levin, R. Maddux, I. Ruzsa.

10–14. **Kinetics of Phase Transitions**, Edinburgh, Scotland. (Jan. 1992, p. 52)

*10–14. **Summer School in the Model Theory of Fields–the Field of Real Numbers with Exponentiation**, University of Crete, Greece. (Please note date change from Jan. 1992, p. 51)

*10–14. **NSF-CBMS Regional Conference: Hopf Algebras and Their Actions on Rings**, DePaul University, Chicago, IL.

INVITED SPEAKERS: S. Montgomery (Featured Lecturer), M. Cohen, Y. Doi, W. Nichols, D. Passman, D. Radford, H. Schneider, M. Takeuchi.

INFORMATION: J. Bergen, Dept. of Math., DePaul U., Chicago, IL 60614; 312-362-8248; email: matjmb@depaul.bitnet; Fax: 312-362-5681.

10–18. **Canadian Mathematical Society Annual Seminar on Representations of Algebras and Related Topics**, Carleton University, Ottawa, Canada. (Dec. 1991, p. 1339)

11–15. **The Seventh KAIST Mathematics Workshop**, Korea Advanced Institute of Science and Technology, Taejon, Korea. (Feb. 1992, p. 146)

13–17. **First Colloquium on Numerical**

Analysis, Plovdiv, Bulgaria. (Oct. 1991, p. 1011)

15–19. **International Conference on Associative Rings**, Irkutsk, USSR. (Feb. 1992, p. 146)

* 16–20. **CRYPTO '92**, University of California, Santa Barbara.

PROGRAM: Original research papers and technical expository talks are solicited on all practical and theoretical aspects of cryptology. It is anticipated that some talks may also be presented by special invitation of the Program Committee.
CALL FOR PAPERS: Authors are requested to send 12 copies of a detailed abstract (not a full paper) by April 27, 1992. Submissions must be anonymous. Send to: E.F. Brickell, CRYPTO '92, Division 1423, Sandia Nat'l Labs., Albuquerque, NM 87185; 505-845-7655; Fax: 505-845-7442; Internet: efbrick@cs.sandia.gov.
INFORMATION: General Chair, S.S. Magliveras, Crypto '92, Dept. of Comp. Sci. and Eng., U. of Nebraska-Lincoln, Lincoln, NE 68588-0115; 402-472-5005; Fax: 402-472-7767; Internet: spyros@helios.unl.edu.

16–22. **Reelle Analysis**, Oberwolfach, Germany. (Jul./Aug. 1991, p. 646)

16–29. **1992 NATO Advanced Study Institute: Wavelets and their Applications**, Tuscany, Italy. (Feb. 1992, p. 146)

17–19. **Algebraic Computing in Geometry**, Linz, Austria. (Feb. 1992, p. 146)

17–21. **The Sixth International Conference on Boundary and Interior Layers–Computational and Asymptotic Methods (BAIL VI)**, Summit County, Colorado. (Nov. 1991, p. 1170)

17–21. **The Alan Day Conference on Lattices and Algebras**, McMaster University, Hamilton, Ontario, Canada. (Nov. 1991, p. 1171)

17–23. **Seventh International Congress on Mathematical Education (ICME-7)**, Université Laval, Québec, Canada. (Sep. 1991, p. 839)

18–22. **Third Colloquium on Differential Equations**, Plovdiv, Bulgaria. (Oct. 1991, p. 1011)

19–22. **Sixth International Conference on Representations of Algebras (ICRA VI)**, Carleton University, Ottawa, Canada. (Dec. 1991, p. 1340)

19–26. **World Congress of Nonlinear Analysts**, Melbourne, FL. (Nov. 1991, p. 1171)

22–28. **Eighteenth International Congress of Theoretical and Applied Mechanics**, Technion–Israel Institute of Technology, Haifa, Israel. (Jan. 1991, p. 52)

23–29. **Mathematical Finance**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

23–29. **Web Geometry**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 53)

25–29. **Sixth School of Algebra and Analysis**, Irkutsk, USSR. (Feb. 1992, p. 146)

26–28. **IMACS RM2S '92 Kobe**, Kobe University, Kobi, Japan. (May/Jun. 1991, p. 477)

30–September 5. **Komplexe Analysis**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 147)

31–September 2. **Fourth International Workshop on Generalized Convexity**, Pécs, Hungary. (Jan. 1992, p. 53)

31–September 4. **Large Scale Scientific Computation**, Universität Bielefeld. (Feb. 1992, p. 146)

31–September 11. **Arithmetic Algebraic Geometry (Advanced Workshop)**, Trieste, Italy. (Jan. 1992, p. 53)

September 1992

September 1992. **IMACS 2nd International Conference on System Simulation and Scientific Computing-BICSC '92**, Beijing, China. (May/Jun. 1991, p. 477)

6–12. **Topologie**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

7–11. **Réseaux**, Marseille, France. (Jan. 1992, p. 53)

7–14. **IMACS Conference on Innovative Methods in Numerical Analysis**, Padova University at Bressanone, Italy. (Jan. 1992, p. 53)

8–11. **IMA Tutorial: Introduction to Linear Multivariable Control, Optimal Design, and Parameter Estimation**, Institute for Mathematics and its Applications, University of Minnesota. (Sep. 1991, p. 839)

9–11. **Royal Statistical Society Full Conference**, Sheffield, UK. (Nov. 1991, p. 1171)

13–19. **4-Dimensional Manifolds**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

13–19. **DMV-Jahrestagung**, Berlin, Federal Republic of Germany. (Jan. 1992, p. 53)

* 13–19. **Symposium on Analytic and Geometric Aspects of Hyperbolic Geometry: Instructional Conference**, University of Warwick, Coventry, UK.

PROGRAM: Throughout the academic year 1992-1993, there will be a special emphasis on recent research in analytic and geometric aspects of hyperbolic geometry. There will be lectures in the morning and workshops in the afternoon. Funds are available for support of UK academic staff and graduate students.
ORGANIZER: D. Epstein (email: dbae@maths.warwick.ac.uk) and C. Series (cms@maths.warwick.ac.uk).
INFORMATION: E. Shiels, Mathematics Institute, University of Warwick, Coventry CV4 7AL; email: es@maths.warwick.ac.uk

14–18. **Twentieth European Meeting of Statisticians**, Bath, UK. (Nov. 1991, p. 1171)

14–18. **Second Atelier International de Théorie des Ensembles**, Marseille, France. (Jan. 1992, p. 53)

14–25. **Algebra (Advanced Workshop)**, Trieste, Italy. (Jan. 1992, p. 53)

16–18. **Second SIAM Conference on Control in the 90s**, Minneapolis, MN. (Feb. 1991, p. 148)

16–20. **IMACS/SICE International Symposium on Robotics, Mechatronics and Manufacturing Systems**, Kobe, Japan. (Jan. 1992, p. 53)

17–19. **International Conference on Group Theory**, University of Timisoara, Romania. (Jul./Aug. 1991, p. 646)

* 17–19. **SIAM Conference on Control and its Applications**, Minneapolis, MN.

ORGANIZER: K. Grasse, U. of Oklahoma, Norman.
INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; Fax: 215-386-7999; meetings@siam.org.

20–26. **Funktionalgeichungen**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

21–23. **Seventh International Conference on Multivariate Analysis in Memory of Ronald A. Fisher**, Barcelona, Spain. (Jan. 1992, p. 53)

21–23. **Workshop on Algebraic Cycles**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1992, p. 53)

21–25. **IMA Workshop on Robust Control Theory**, Institute for Mathematics and its Applications, University of Minnesota. (Sep. 1991, p. 839)

27–October 3. **Darstellungstheorie Endlicher Gruppen**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

30–October 2. **Thirtieth Annual Allerton Conference on Communication, Control, and Computing**, University of Illinois, IL. (Feb. 1992, p. 147)

31–October 4. **Third International Conference on Function Spaces**, Institute of Mathematics, Adam Mickiewicz University, Poznan, Poland. (Feb. 1992, p. 147)

October 1992

* 2–3. **Fourth Midwest Conference on the History of Mathematics**, Miami University, Oxford, OH.

PRINCIPLE SPEAKERS: J. Grabiner, Pitzer College; W. Dunham, Hanover College; V.

Katz, U. of the District of Columbia; F. Rickey, Bowling Green State U.
CALL FOR PAPERS: Abstracts for contributed papers should be sent by June 1, 1992 to the address below.
INFORMATION: D.E. Kullman, Conference Director, Dept. of Math. and Stat., Miami U., Oxford, OH 45056; Tel: 513-529-6538.

4–10. **Funktionalanalysis**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

11–17. **Arbeitsgemeinschaft mit Aktuellem Thema**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

12–16. **IMA Workshop on Control Systems Design for Advanced Engineering Systems: Complexity, Uncertainty, Information, and Organization**, Institute for Mathematics and its Applications, University of Minnesota. (Sep. 1991, p. 840)

12–16. **Workshop on Visualization of Geometric Structures**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1992, p. 54)

12–16. **International Conference on Polynomial Automorphisms and Related Topics**, CIRM, Luminy, France. (Jan. 1992, p. 54)

14–20. **First African Conference on Research in Computer Science**, Yaounde, Cameroon. (Feb. 1992, p. 147)

* 15–19. **SIAM Conference on Applications of Dynamical Systems**, Salt Lake City, UT. (Please note date change from Jul./Aug. 1991, p. 646)

* 17. **Three Decades of Numerical Linear Algebra at Berkeley: A Conference in Honor of the Sixtieth Birthdays of Beresford Parlett and William Kahan**, University of California, Berkeley.

ORGANIZING COMMITTEE: J. Bunch, UCSD, jbunch@ucsd.edu; J. Demmel, UC Berkeley, demmel@wsparc.berkeley.edu; and H. Simon, NASA Ames, simon@nas.nasa.gov.
CALL FOR PAPERS: There will be a special issue of the *Journal of Numerical Linear Algebra with Applications* (*JNLAA*) dedicated to Parlett and Kahan. The deadline for submission of manuscripts is October 17, 1992.

18–24. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

19–21. **The Fourth Symposium on the Frontiers of Massively Parallel Computation**, McLean, VA. (Dec. 1991, p. 1340)

19–23. **Modeles Arch et Applications a la Finance**, Marseille, France. (Jan. 1992, p. 54)

19–23. **Fourth International Symposium on Orthogonal Polynomials and their Applications**, Evian, France. (Feb. 1992, p. 148)

20–23. **Second Beijing International Conference on System Simulation and Scientific Computing-BICSC '92**, Beijing, China. (Jan. 1992, p. 54)

22–30. **Forty-sixth Conference and Congress of the International Federation for Information and Documentation**, Madrid, Spain. (May/Jun. 1991, p. 477)

25–31. **Stochastische Analysis**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

30–November 1. **Central Section**, Wright State University, Dayton, OH.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6887, Povidence, RI 02940.

November 1992

November 1992. **The International Lie-Lobachevsky Colloquium Dedicated to the Anniversaries of Sophus Lie's 150 birthday and Nikolai Lobachevski's 200 birthday**, Tartu (Estonia). (Feb. 1992, p. 148)

1–6. **The First Pan American Conference on Pre-Columbia Mathematics, Astronomy, and Modes of Thought**, Univ. Francisco Marroquín, Guatamala City and Tikal. (Dec. 1991, p. 1340)

1–7. **Kombinatorik**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

2–6. **Workshop on Symbolic Dynamics**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1992, p. 54)

8–14. **Numerische Integration**, Oberwolfach, Federal Republic of Germany. (February 1991, p. 148)

* 8–14. **Third Austrian Symposium on the History of Mathematics**, Neuhofen an der Ybbs (Lower Austria).

PROGRAM: The theme of the conference will be "Detours, shortcuts, dead ends, and other deviations from the 'normal' path of the development of mathematics."
INFORMATION: C. Binder, Institute for Technical Mathematics, TU Vienna, Wiedner Hauptstr. 8-10/1141, A-1040 Vienna, Austria; chbinder@email.tuwien.ac.at; tel: +43-(0)222-58801-5389.

9–13. **IMA Workshop on Control and Optimal Design of Distributed Parameter Systems**, Institute for Mathematics and its Applications, University of Minnesota. (Nov. 1991, p. 1171)

14–16. **The Third Biennial Conference of the Allahabad Mathematical Society**, Allahabad, India. (May/Jun. 1991, p. 477)

15–20. **An Applications Symposium on Optics, Electro-Optics, and Lasers in Industry**, Boston, MA. (Feb. 1992, p. 148)

15–21. **Komplexitatstheorie**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

16–18. **Workshop on Higher Dimensional Geometry**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1992, p. 54)

16–20. **International Congress on Numerical Methods in Engineering and Applied Sciences**, University of Concepción, Concepción, Chile. (Jul./Aug. 1991, p. 646)

16–20. **IMA Period of Concentration: Flow Control**, Institute for Mathematics and its Applications, University of Minnesota. (Sep. 1991, p. 840)

23–25. **European Symposium on Research in Computer Security**, Toulouse, France. (Feb. 1992, p. 148)

23–27. **Séminaire Sud-Rhodanien de Geometrie**, Marseille, France. (Jan. 1992, p. 54)

29–December 5. **Theory of Large Deviations**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

December 1992

2–4. **Workshop on Curves, Abelian Varieties, and their Moduli**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1992, p. 54)

4–5. **International Workshop on Matrix Methods for Statistics**, University of Auckland, Auckland, New Zealand. (Feb. 1992, p. 148)

6–12. **Theory and Numerical Methods for Initial-Boundary Value Problems**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

7–11. **IMACS Symposium on Scientific Computing and Mathematical Modelling**, Bangalore, India. (May/Jun. 1991, p. 477)

* 11–16. **Workshop on Generalized Inverses–Computational Techniques and Applications**, Indian Statistical Institute, Delhi, India.

INFORMATION: U.S. representatives: R. Hartwig (NCSU) and S.K. Jaim (Ohio U.). Contact Mitra: isid!mitra%vikram@shakti.ernet.in.

13–19. **Asymptotische Statistik**, Oberwolfach, Federal Republic of Germany. (Feb. 1991, p. 148)

15–17. **Third IMA Conference on Mathematics Signal Processing**, University of Warwick, England. (Feb. 1992, p. 149)

27–31. **Holiday Symposium on Lie Group Representations and Combinatorics**, New Mexico State University, Las Cruces, NM. (Sep. 1991, p. 840)

1993

1992–1993. **Mittag-Leffler Institute's Academic Program for 1992–1993: Special Prob-**

lems in Mathematical Physics, Djursholm, Sweden. (Nov. 1991, p. 1171)

Spring 1993. **IMACS Symposium on Mathematical Modelling**, Wiener Neustadt, Germany. (Jan. 1992, p. 54)

1993. **Second IMACS International Conference on Computational Physics**, Univ. of Colorado, Boulder, CO. (Jan. 1992, p. 55)

January 1993

3–7. **International Conference on Scientific Computation and Differential Equations**, Auckland, New Zealand. (May/Jun. 1991, p. 477)

3–9. **Grundlagen der Geometrie**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

3–9. **Extensions of Buildings and Geometries**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

4–9. **Advances in Computational Mathematics**, India International Center, New Delhi, India. (Feb. 1992, p. 149)

10–16. **Computational Methods for Nonlinear Phenomena**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

13–16. **Joint Mathematics Meetings**, San Antonio, TX. (including the annual meetings of the AMS, AWM, MAA, and NAM)

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

17–22. **1993 IEEE International Symposium on Information Theory**, San Antonio, TX. (Feb. 1992, p. 149)

17–23. **Combinatorial Optimization**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

24–30. **Optimale Steuerung Partieller Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

*25–27. , **Fourth ACM-SIAM Symposium on Discrete Algorithms.**

ORGANIZER: D.S. Johnson, AT&T Bell Labs.
CALL FOR PAPERS: Abstract deadline: July 12, 1992.
INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; Fax: 215-386-7999; meetings@siam.org.

25–29. **IMA Workshop on Robotics**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1171)

31–February 6. **Asymptotics and Adaptivity in Computational Mechanics**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

February 1993

1–3. **IMA Minisymposium on Biological Control of Movement**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

7–13. **Partielle Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

*8–17. **IMA Workshop on Nonsmooth Analysis and Geometric Methods in Deterministic Optimal Control**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN.

INFORMATION: Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church St., SE, Minneapolis, MN 55455.

14–20. **Applicable Algebra**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

16–25. **IMA Workshop on Nonsmooth Analysis and Geometric Methods in Control**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

21–27. **Curves, Images, Massive Computation**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

25–March 1. **A Conference on Numerical Analysis with Automatic Result Verification**, Lafayette, LA. (Jan. 1992, p. 55)

28–March 6. **Medical Statistics: Statistical Methods for Risk Assessment**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

March 1993

7–13. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

14–20. **Gewöhnliche Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

15–19. **IMA Workshop on Systems and Control Theory for Power Systems**, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN. (Nov. 1991, p. 1172)

*21–24. **Sixth SIAM Conference on Parallel Processing for Scientific Computing**, Norfolk, VA.

ORGANIZER: R.G. Voigt, ICASE.
CALL FOR PAPERS: Abstract deadline: 9/14/92.
INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; Fax: 215-386-7999; meetings@siam.org.

21–27. **Analysis auf Lokalsymmetrischen Räumen**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 55)

24–25. **Central Section**, DePaul University, Chicago, IL.

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

28–April 3. **Combinatorial Convexity and Algebraic Geometry**, Oberwolfach, Federal Republic of Germany. (Jan. 1992, p. 56)

April 1993

*15–22. **Symposium on Analytic and Geometric Aspects of Hyperbolic Geometry: Research Level Workshop**, University of Warwick, Coventry, UK.

PROGRAM: Throughout the academic year 1992-1993, there will be a special emphasis on recent research in analytic and geometric aspects of hyperbolic geometry. Funds are available for support of UK academic staff and graduate students.
ORGANIZER: D. Epstein (email: dbae@maths.warwick.ac.uk) and C. Series (cms@maths.warwick.ac.uk).
INFORMATION: E. Shiels, Mathematics Institute, University of Warwick, Coventry CV4 7AL; email: es@maths.warwick.ac.uk

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.

July 1993

*4–9. **Fifth International Fuzzy Systems Association World Congress**, Seoul, Korea.

PROGRAM: The objectives of the congress are twofold: the first is to encourage communication between researchers throughout the world whose research either draws support from, or complements, the theory and applications of fuzzy set related models, and the second is to explore industrial applications of fuzzy systems technology to make systems more convenient.
CONFERENCE TOPICS: **Intelligent systems**, papers to be sent to: J.C. Bezdek, Dept. of Comp. Sci., U. of West Florida, Pensacola, FL 32514; email: jbezdek@uwf.bitnet. **Engineering**, papers sent to: K. Hirota, Dept. of Instrument and Control Eng., College of Eng., Hosei U., Kajino-cho, Koganei-city, Tokyo 184 Japan; email: hirota@hrt.hosei.ac.jp. **Mathematical foundations**, papers sent to: R. Lowen, Dept.

of Math. and Informatics, U. of Antwerp, RUCA, Groenenborgeriaan 171, 2020, Antwerpen, Belgium; email: lowen@banruc60.bitnet. **Information Sciences**, papers sent to: K.W. Oh, Dept. of Comp. Sci., Sogang U., C.P.O. Box 1142 Seoul, 100-611 Korea; email: kwoh@krsogang.bitnet.
CALL FOR PAPERS: Four page extended abstracts to the area chairs due by Oct. 1, 1992.
INFORMATION: General Chairman, Z. Bien, Dept. of Electrical Engineering, KAIST, 373-1 Kusong-dong, Yusung-gu, Taejon, 305-701 Korea; tel: 82-42-829-3419; Fax: 82-42-829-3410; email: zbien@kumkang.kaist.ac.kr.; or Congress Secretary, c/o K.C. Min, Dept. of Math., Yonsei U., Seoul 120-749 Korea; tel: 82-2-361-2591; Fax: 82-2-392-6634; email: kcmin@ysucc1.bitnet.

* 12–16. **SIAM Annual Meeting**, Philadelphia, PA.

INFORMATION: SIAM Conference Coordinator, 3600 University City Science Center, Philadelphia, PA 19104-2688; 215-382-9800; Fax: 215-386-7999; meetings@siam.org.

October 1993

* 31–November 6. **Algorithmische Methoden der Diskreten Mathematik**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: M. Golumbic, Halfa; R. Möhring, Berlin; R. Seidel, Berkeley.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach Geschäftsstelle: Alberstrasse 24 D-7800 Freiburg im Breisgau.

November 1993

* 21–27. **Mathematische Modelle in der Biologie**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: K.P. Hadeler, Tübingen; P. Maini, Oxford; L.A. Segel, Rehovot.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach Geschäftsstelle: Alberstrasse 24 D-7800 Freiburg im Breisgau.

* 28–December 4. **Nonlinear Equations in Many-Particle Systems**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: J. Batt, München; C. Cercignani, Milano.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach Geschäftsstelle: Alberstrasse 24 D-7800 Freiburg im Breisgau.

August 1994

* 3–11. **The International Congress of Mathematicans 1994**, Zürich, Switzerland. (Please note official conference address provided, which differs from Mar. 1991, p. 244)

INFORMATION: ICM 94, ETH-Zentrum, CH-8092 Zürich, Switzerland, email: icm94@math.ethz.ch.

1995

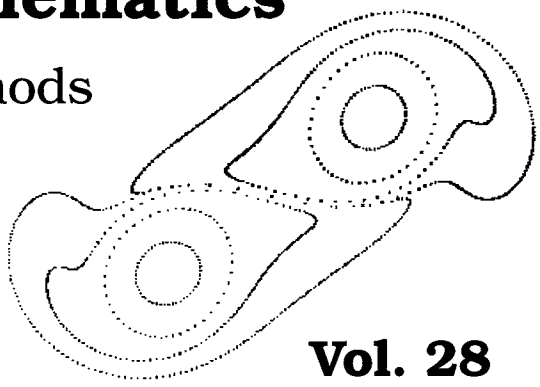
* **Second International Conference on Numerical Methods for Volterra and Delay Equations (A conference to celebrate the 100th anniversary of Volterra's birth.)**, Italy.

INFORMATION: A. Feldstein, Dept. of Math., Arizona State Univ., Tempe, AZ 85287.

Lectures in Applied Mathematics

Vortex Dynamics and Vortex Methods

Christopher R. Anderson and Claude Greengard, *Editors*



Vol. 28

This volume contains the proceedings from the AMS-SIAM Summer Seminar on Vortex Dynamics and Vortex Methods, held in June, 1990 at the University of Washington in Seattle.

The focus of *Vortex Dynamics and Vortex Methods* is the numerical computation of high Reynolds number incompressible flows. Also included is a smaller selection of important experimental results and analytic treatments. Many of the articles contain valuable introductory and survey material as well as open problems. You and your students will appreciate this volume for its coverage of a wide variety of numerical, analytical, and experimental tools and for its treatment of important discoveries made with these tools.

1991 *Mathematics Subject Classifications*: 76, 65, ISBN 0-8218-1135-9, 751 pages (softcover), December 1991, **Individual member $89**, List price $149, Institutional member $119. To order, please specify LAM/28NA

All prices subject to change. Free shipment by surface: for air delivery, please add $6.50 per title. *Prepayment required.* **Order from** American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS in the continental U.S. and Canada to charge with VISA or MasterCard. Please add 7% GST to all orders totalling over $40 being shipped to Canada.

New AMS Publications

LIE GROUPS, THEIR DISCRETE SUBGROUPS, AND INVARIANT THEORY
E. B. Vinberg, Editor
(Advances in Soviet Mathematics, Volume 8)

For the past thirty years, E. B. Vinberg and L. A. Onishchik have conducted a seminar on Lie groups at Moscow University; about five years ago V. L. Popov became the third co-director, and the range of topics expanded to include invariant theory. Today, the seminar encompasses such areas as algebraic groups, geometry and topology of homogeneous spaces, and Kac-Moody groups and algebras. This collection of papers presents a snapshot of the research activities of this well-established seminar, including new results in Lie groups, crystallographic groups, and algebraic transformation groups. These papers will not be published elsewhere. Readers will find this volume useful for the new results it contains as well as for the open problems it poses.

Contents

A. L. Onishchik, V. L. Popov, and E. B. Vinberg, *Preface*; **A. V. Alekseevskiĭ and D. V. Alekseevskiĭ**, *G-manifolds with one-dimensional orbit space*; **V. O. Bugaenko**, *Arithmetic crystallographic groups generated by reflections and reflective hyperbolic lattices*; **A. G. Elashvili**, *Invariant algebras*; **L. Yu. Galitskiĭ**, *On the existence of Galois sections*; **V. V. Gorbatsevich**, *On some cohomology invariants of compact homogeneous manifolds*; **A. A. Katanova**, *Explicit form of certain multivector invariants*; **P. I. Katsylo**, *On the birational geometry of the space of ternary quartics*; **P. I. Katsylo**, *Rationality of the module variety of mathematical instantons with $c_2 = 5$*; **A. L. Onishchik and A. A. Serov**, *Holomorphic vector fields on super-Grassmannians*; **D. I. Panyushev**, *Affine quasihomogeneous normal SL_2-varieties: Hilbert function and blow-ups*; **D. I. Panyushev**, *Complexity of quasiaffine homogeneous varieties, t-decompositions, and affine homogeneous spaces of complexity 1*; **V. L. Popov**, *On the "Lemma of Seshadri"*; **D. A. Shmel'kin**, *Coregular algebraic linear groups locally isomorphic to SL_2*; **O. V. Shvartsman**, *An example of a nonarithmetic discrete group in the complex ball*; **G. A. Soĭfer**, *Free subsemigroups of the affine group, and the Schoenflies-Bieberbach theorem*.

1991 *Mathematics Subject Classifications*: 14D, 14F, 14J, 14L, 15A, 17B, 20G, 20H, 22E, 32M, 53C, 57S, 57T
ISBN 0-8218-4107-6, LC 91-640741, ISSN 1051-8037
204 pages (hardcover), March 1992
Individual member $71, List price $119,
Institutional member $95
To order, please specify ADVSOV/8N

SPECTRAL THEORY OF OPERATORS
S. G. Gindikin, Editor
(American Mathematical Society Translations, Series 2, Volume 150)

Containing the proceedings of the Fourteenth School on Operators in Functional Spaces, held in Novgorod, USSR, in the summer of 1989, this volume focuses on the spectral theory of differential operators. The emphasis is on estimates of the number of negative eigenvalues of elliptic differential operators and on the analysis of asymptotical distribution of eigenvalues. Three of the papers discuss distribution of eigenvalues, while the fourth studies scattering theory. The authors rank among the leading Soviet specialists in this area of research. Aimed at researchers in spectral theory of differential operators, scattering theory, and related problems in mathematical physics, this collection provides an excellent overview of some of the major problems in the field.

Contents

D. G. Vasil'ev and Yu. G. Safarov, *Asymptotic distribution of eigenvalues of differential operators*; **M. S. Birman and M. Z. Solomyak**, *Schrödinger operator. Estimates for the number of bound states as a function-theoretical problem*; **Yu. A. Kuperin and S. P. Merkur'ev**, *Selfadjoint extensions and scattering theory for several-body systems*; **Yu. V. Egorov and V. A. Kondrat'ev**, *Estimates of the negative spectrum of an elliptic operator*.

1991 *Mathematics Subject Classifications*: 34L20, 34L25, 34L30, 34L40, 47A13, 47A40, 47H12
ISBN 0-8218-7500-0, LC 91-41699, ISSN 0065-9290
176 pages (hardcover), March 1992
Individual member $67, List price $112,
Institutional member $90
To order, please specify TRANS2/150N

DIFFERENTIAL GEOMETRY, GLOBAL ANALYSIS, AND TOPOLOGY
A. Nicas and W. F. Shadwick, Editors
(Conference Proceedings, Canadian Mathematical Society, Volume 12)

This book contains the proceedings of a special session on differential geometry, global analysis, and topology, held during the Summer Meeting of the Canadian Mathematical Society in June 1990 at Dalhousie University in Halifax. The session featured many fascinating talks on topics of current interest. The articles collected here reflect the diverse interests of the participants but are united by the common theme of the interplay among geometry, global analysis, and topology. Some

Use the order form in the back of this issue or call 800-321-4AMS (800-321-4267) in the U.S. and Canada to use VISA or MasterCard.

of the topics include applications to low dimensional manifolds, control theory, integrable systems, Lie algebras of operators, and algebraic geometry. Readers will appreciate the insight the book provides into some recent trends in these areas.

Contents

J. Bland, M. Kalka, and R. W. Sharpe, *Complete metrics of negative Ricci curvature on open 3-manifolds*; **D. DeTurck, H. Goldschmidt, and J. Talvacchia**, *Local existence of connections with prescribed curvature*; **C. Frohman and A. Nicas**, *The Alexander polynomial via topological quantum field theory*; **R. B. Gardner and W. F. Shadwick**, *An equivalence problem for a two-form and a vector field on* $\mathbb{R}^3$; **A. González-López, N. Kamran, and P. J. Olver**, *Lie algebras of first order differential operators in two complex variables*; **J. Hurtubise**, *Algebraic geometry and completely integrable Hamiltonian systems*; **I. Kupka**, *On feedback equivalence*; **J. Millson**, *Rational homotopy theory and deformation problems from algebraic geometry*; **C. Peters**, *Introduction to the theory of compact complex surfaces*; **C. T. Simpson**, *Products of matrices*.

1991 *Mathematics Subject Classifications*: 14-06, 53-06, 57-06, 58-06; 14B07, 14F05, 14J10, 17B66, 53C05, 53C21, 57M25, 57M50, 58F07, 93B29, 93B52
ISBN 0-8218-6017-8, ISSN 0731-1036
185 pages (softcover), March 1992
Individual member $30, List price $50,
Institutional member $40
To order, please specify CMSAMS/12N

ALGEBRAIC K-THEORY, COMMUTATIVE ALGEBRA, AND ALGEBRAIC GEOMETRY
R. Keith Dennis, Claudio Pedrini, and Michael R. Stein, Editors

(Contemporary Mathematics, Volume 126)

In the mid-1960s, several Italian mathematicians began to study the connections between classical arguments in commutative algebra and algebraic geometry, and the contemporaneous development of algebraic K-theory in the U.S. These connections were exemplified by the work of Andreotti-Bombieri, Salmon, and Traverso on seminormality, and by Bass-Murthy on the Picard groups of polynomial rings. Interactions proceeded far beyond this initial point to encompass Chow groups of singular varieties, complete intersections, and applications of K-theory to arithmetic and real geometry.

This volume contains the proceedings from a U.S.–Italy Joint Summer Seminar, which focused on this circle of ideas. The conference, held in June 1989 in Santa Margherita Ligure, Italy, was supported jointly by the Consiglio Nazionale delle Ricerche and the National Science Foundation. The book contains contributions from some of the leading experts in this area.

Contents

M. Boratynski, *On the curves of contact on surfaces in a projective space*; **L. Chiantini**, *Plane sections of curves of low genus*; **C. Consani**, *A moving-lemma for a singular variety and applications to the Grothendieck group* $K_0(X)$; **K. R. Coombes**, *The* K*-cohomology of Enriques surfaces*; **O. Gabber**, K*-theory of Henselian local rings and Henselian pairs*; **J. Hurrelbrink, J. Morita, and U. Rehmann**, *On the homological* π_0 *of Kac-Moody groups over fields*; **B. Kahn**, *The decomposable part of motivic cohomology and bijectivity of the norm residue homomorphism*; **S. E. Landsburg**, *On the spectral sequence for relative* K*-theory*; **R. C. Laubenbacher and D. L. Webb**, G_0 *of integral group rings for groups with cyclic Sylow subgroups*; **M. Levine**, *Deligne-Beilinson cohomology for singular varieties*; **M. Mazur and J. Urbanowicz**, *A note on* K_2 *of the rings of integers of totally real number fields*; **L. Reid and L. G. Roberts**, *Intersection points of seminormal configurations of lines*; **C. C. Sherman**, *Group representations and algebraic* K*-theory: II*; **J. Urbanowicz**, *Remarks on the Stickelberger ideals of order 2*; **L. N. Vaserstein**, *Unstable* K_1*-theory of topological spaces is nilpotent*; **L. B. Viale**, *Cohomology theories and algebraic cycles in singular varieties*; **C. Weibel and D. Yao**, *Localization for the* K*-theory of noncommutative rings*.

1991 *Mathematics Subject Classifications*: 19-06, 14-06, 13D15, 14C35; 19Axx, 19Bxx, 19Dxx
ISBN 0-8218-5130-6, LC 91-45311, ISSN 0271-4132
230 pages (softcover), March 1992
Individual member $35, List price $59,
Institutional member $47
To order, please specify CONM/126N

TOPOLOGY OF FOLIATIONS: AN INTRODUCTION
Itiro Tamura

(Translations of Mathematical Monographs, Volume 97)

This book provides historical background and a complete overview of the qualitative theory of foliations and differential dynamical systems. Senior mathematics majors and graduate students with background in multivariate calculus, algebraic and differential topology, differential geometry, and linear algebra will find this book an accessible introduction. Upon finishing the book, readers will be prepared to take up research in this area. Readers will appreciate the book for its highly visual presentation of examples in low dimensions. The author focuses particularly on foliations with compact leaves, covering all the important basic results. Specific topics covered include: dynamical systems on the torus and the three-sphere, local and global stability theorems for foliations, the existence of compact leaves on three-spheres, and foliated cobordisms on three-spheres. Also included is a short introduction to the theory of differentiable manifolds.

Contents

Nonsingular dynamical systems on the torus; C^r *manifolds and tangent spaces*; *Dynamical systems and limit sets*; *Foliations*; *Stability theorems on foliations*; *The existence of compact leaves*; *Foliations and differential forms*; *Cobordisms of foliations*.

1991 *Mathematics Subject Classifications*: 57R30; 58F18
ISBN 0-8218-4543-8, LC 91-37135, ISSN 0065-9282
193 pages (hardcover), March 1992
Individual member $53, List price $89,
Institutional member $71
To order, please specify MMONO/97N

SUMS OF EVEN POWERS OF REAL LINEAR FORMS
Bruce Reznick

(Memoirs of the AMS, Number 463)

This work initiates a systematic analysis of the representation of real forms of even degree as sums of powers of linear forms and the resulting implications in real algebraic geometry, number theory, combinatorics, functional analysis, and numerical analysis. This subject is closely related to the study of positive semidefinite forms and their representation of sums of squares of forms, begun by Hilbert and revived by Motzkin, R. M. Robinson, Choi, and Lam. Under suitable reinterpretation, some

of the results can be traced to work of Akhiezer and Krein in the classical moment problem. Since the time of Liouville, representations of the form $h_{n,2s} = (x_1^2 + \cdots + x_n^2)^5$ as a sum of $2s$-th powers have been used in the study of Waring's problem, and they are equivalent to certain Banach space embeddings. The proofs utilize elementary techniques from linear algebra, convexity, number theory, and real agebraic geometry, and many explicit examples and relevant historical remarks are presented.

Contents

Cones of n-ary m-ics and their duals; *Representations as sums of m-th powers*; *Binary forms and ternary quartics*; *Moment problems*; *Quadrature problems*; *Representations of $h_{n,m}$*; *Minimal representations of $h_{n,m}$*; *Further questions.*

1991 *Mathematics Subject Classifications*: 11E76; 05B30, 11P05, 12D10, 14N99, 26C99, 44A60, 46B04, 52A21, 65D32
ISBN 0-8218-2523-2, LC 91-44877, ISSN 0065-9266
155 pages (softcover), March 1992
Individual member $19, List price $29,
Institutional member $24
To order, please specify MEMO/463N

KERNEL FUNCTIONS, ANALYTIC TORSION, AND MODULI SPACES

John Fay

(Memoirs of the AMS, Number 464)

This work investigates analytic torsion on the moduli space of degree zero stable bundles on a compact Riemann surface. Zeta-function regularization and perturbation-curvature formulas for torsion are developed using a modified resolvent-Szego kernel. The author discusses the bosonization formulas of mathematical physics, Riemann vanishing theorems for torsion, and analytic properties (insertion-residue formulas and heat equations) for the nonabelian theta function and Szego kernel. In addition, he provides background material on bundle-moduli spaces, Quillen metrics, and theta functions.

Contents

Theta functions; *Kernel functions and analytic torsion*; *Variational formulas*; *Torsion on the moduli space of stable bundles*; *Torsion on Teichmuller space.*

1991 *Mathematics Subject Classifications*: 32G13, 14K25, 30C40
ISBN 0-8218-2550-X, LC 91-44876, ISSN 0065-9266
123 pages (softcover), March 1992
Individual member $18, List price $27,
Institutional member $23
To order, please specify MEMO/464N

SELBERG TRACE FORMULAE AND EQUIDISTRIBUTION THEOREMS FOR CLOSED GEODESICS AND LAPLACE EIGENFUNCTIONS: FINITE AREA SURFACES

Steven Zelditch

(Memoirs of the AMS, Number 465)

This work is concerned with a pair of dual asymptotics problems on a finite-area hyperbolic surface. The first problem is to determine the distribution of closed geodesics in the unit tangent bundle. The author's results give a quantitative form to Bowen's equidistribution theory: they refine Bowen's theorem much as the prime geodesic theorem on hyperbolic quotients refines the asymptotic formula for the number of closed geodesics of length less than T. In particular, the author gives a rate of equidistribution in terms of low eigenvalues of the Laplacian. The second problem is to determine the distribution of eigenfunctions (in a microlocal sense) in the unit tangent bundle. The main result here (which is needed for the equidistribution theory of closed geodesics) is a proof of a signed and averaged version of the mean Lindelöf hypothesis for Rankin-Selberg zeta functions. The main tool used here is a generalization of Selberg's trace formula.

Contents

Review of [Z.2] on the compact case; *Trace formula for Tr σR_φ^Γ (σ cuspidal)*; *Trace formula for Tr σR_φ^Γ (σ Eisenstein)*; *Spectral estimates (Weyl laws)*; *Asymptotic expansions (Prime geodesic theorems)*; *Equidistribution of closed geodesics.*

1991 *Mathematics Subject Classifications*: 11F, 58F; 58G
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VERTEX ALGEBRAS AND INTEGRAL BASES FOR THE ENVELOPING ALGEBRAS OF AFFINE LIE ALGEBRAS

Shari A. Prevost

(Memoirs of the AMS, Number 466)

Since its debut in the mathematical literature a little more than a decade ago, the theory of vertex operators has flourished. In addition to yielding all the finite-dimensional irreducible representations of the simple Lie algebras, vertex operators have provided a very natural setting for studying affine Lie algebras and their representations. Perhaps the major contribution to date of the theory is the construction of the Monster and the Moonshine module. Vertex operator theory also plays a fundamental role in string theory.

In the present work, the author utilizes the vertex operator representations of the affine Lie algebras to give two equivalent descriptions of an integral basis for the affine Lie algebras and their associated universal enveloping algebras. The first basis exhibited is the vertex operator algebra version of the explicit $\mathbb{Z}$-basis given by Garland and Mitzman. Next, the author examines the vertex algebra approach developed by Borcherds to give a (nonexplicit) description of an integral form for the enveloping algebras for the simply-laced affines. She then extends Borcherds' method to give an analogous description of an integral basis for the remaining unequal root length affine Lie algebras and their enveloping algebras.

Contents

Construction of the affine Lie algebras; *The main theorem*; *Vertex algebras and integral forms of the universal enveloping algebras of the affine Lie algebras.*

1991 *Mathematics Subject Classifications*: 17B35, 17B65, 17B67
ISBN 0-8218-2527-5, LC 91-44874, ISSN 0065-9266
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APPROXIMATION, INTERPOLATION, AND SUMMABILITY

S. Baron and D. Leviatan, Editors

(Israel Mathematical Conference Proceedings, Volume 4)

This volume contains the proceedings of an international conference in honor of the sixty-fifth birthday of Professor Amnon Jakimovski. The conference, "Approximation, Interpolation, and Summability," was held at Tel-Aviv University and Bar-Ilan University in June 1990. A leading figure in mathematics in Israel and internationally, Professor Jakimovski has distinguished himself for his research in the area of the conference and particularly in summability, inclusion and consistency theorems, Tauberian theorems, analytic continuation, Toeplitz bases, and integral transforms. He has been on the faculty of Tel-Aviv University, serving in a number of administrative posts there, and has been active in a number of educational efforts. The papers in this volume range from current research to surveys and expository works. All of the articles were refereed and presented at the conference.

Contents

S. Baron and D. Leviatan, *Prof. Amnon Jakimovski—On his sixty-fifth birthday*; **D. C. Russell**, *Interpolation—Some work of Amnon Jakimovski*; **G. A. Anastassiou, C. Cottin, and H. H. Gonska**, *Global smoothness preservation by multivariate approximation operators*; **W. Beekmann and S.-C. Chang**, *On distinguished subsets and conullity of FK-spaces*; **H. Berens and Y. Xu**, *On Bernstein-Durrmeyer polynomials with Jacobi-weights: The cases $p = 1$ and $p = \infty$*; **J. Boos and T. Leiger**, *Weak domains of operator valued matrices*; **D. Borwein**, *The non-local nature of the summability of Fourier series by certain absolute Reisz methods*; **Yu. A. Brudnyi**, *The phenomenon of "Better than Best" approximation*; **M. Buntinas and N. Tanović-Miller**, *Integrability classes and summability*; **P. L. Butzer and M. Hauss**, *Stirling functions of first and second kind; Some new applications*; **W. Chen and Z. Ditzian**, *Multivariate Durrmeyer-Bernstein operators*; **Z. Ciesielski**, *Numerical weighted integration of convex functions of algebraic polynomials over cubes*; **C. Franchetti**, *On the Jung constant in Banach spaces with a symmetric norm*; **H. Gingold**, *Eventual summability at a singular point*; **M. V. Golitschek**, *Existence theorems in multivariate approximation*; **E. Jürimäe**, *Replaceability for λ-summability*; **J. Lippus**, *Fourier multipliers of classes of functions with a given order of magnitude of the modulus of continuity*; **G. Mastroianni and J. Szabados**, *Polynomial approximation of analytic functions with singularities*; **H. Mevissen and R. J. Nessel**, *Riemann integrability and the best approximation by trigonometric polynomials*; **F. Móricz**, *Integrability of double trigonometric series in the sense of improper Riemann integral*; **J. Müller**, *Approximation with lacunary polynomials in the complex plane*; **P. Rabinowitz**, *Uniform convergence of Cauchy principal value integrals of interpolating splines*; **W. Schempp**, *Holographic neural networks and holographic fractals*; **B. Shekhtman**, *Some idempotent matrices of large rank*; **P. Vértesi**, *Recent results on Hermite-Fejér interpolations of higher order (uniform metric)*; **X.-L. Zhou**, *Approximation by Hermite-Fejér operators*.

1991 *Mathematics Subject Classifications*: 41, 42, 40
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REPRESENTATIONS OF FINITE DIMENSIONAL ALGEBRAS

H. Tachikawa and V. Dlab, *Editors*

Proceedings of the Tsukuba International Conference (Fifth ICRA) held August 13—18, 1990

Tachikawa and Dlab's book offers you a look into the rapid development of research on representations of finite-dimensional algebras and group representations. A subset of fifty-seven lectures are collected here, together with a number of other papers not originally presented at the conference. With contributions by some of the world's leading experts, Representations of Finite Dimensional Algebras provides a valuable overview of the frontier of research in representations of algebras.

1991 *Mathematics Subject Classifications*: 16; 20
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CMS - AMS Vol. 11

AMS Reports and Communications

The October Meeting in Fargo

The 869th of the American Mathematical Society was held at North Dakota State University in Fargo, North Dakota on October 25 and 26, 1991. There were 214 registrants, including 187 members of the Society.

Invited Addresses. By invitation of the Central Section Program Committee, there were four invited addresses. The speakers, their affiliations, and their titles were as follows:

IAN G. MACDONALD, Queen Mary College, *Constant term identities and conjectures*; HARALD UPMEIER, University of Kansas, *Operator theory and quantization in several complex variables*; HENRY C. WENTE, University of Toledo, *Constant mean curvature immersions: A geometrical approach*; and SYLVIA M. WEIGAND, University of Nebraska, Lincoln, *Prime ideals and decompositions of modules*. The speakers were introduced by Jonathon Hall, Norberto Salinas, Robert Gulliver, and Christel Rotthaus, respectively.

Special Sessions. By invitation of the same committee, there were ten special sessions of selected 20-minute papers. The topics, the names and affiliations of the organizers, and the speakers were as follows:

Commutative algebra, JOSEPH P. BRENNAN, North Dakota State University, Fargo, and SYLVIA M. WEIGAND, University of Nebraska, Lincoln. Speakers were R. Weigand, F. Demeyer, B. Nashier, C. Rotthaus, D. Weston, D. D. Anderson, B. Ulrich, J. Sally, T. Marley, I. Swanson, W. Heinzer, S. Cutkosky, B. Johnston, A. Geramita, S. Abhyanker, D. Finston, R. Fossum, H. Srinivasan, S. Landsberg, L. Avramov, J. Eagon, Y. Ma, S. Mandal, S. Dutta, and H.-B. Foxby.

Algebraic geometry, DAVID B. JAFFEE, University of Nebraska, Lincoln. Speakers were B. Harbourne, B. Crauder, C. Walter, C. Ban, P. Aluffi, A. Arapura, M. Spurr, D. Lorenzini, J. Migliore, D. Jaffee, M. Gross, C. Keem, M. Spivakovsky, R. Miranda, M. Murthy, D. Meuser, and M. Ravi.

Nonlinear wave equations, SATYANAD KICHENASSAMY, University of Minnesota, Minneapolis. Speakers were P. Delft, P. Olver, H. Segur, D. Sattinger, W. Littman, and S. Kichenassamy.

Nonselfadjoint operator algebras, JUSTIN R. PETERS III, Iowa State University, and WARREN R. WOGEN, University of North Carolina, Chapel Hill. Speakers were P. Muhly, A. Hopenwasser, M. Lamoureux, S.-K. Tsui, Z.-J. Ruan, B. Wagner, T. Hudson, T.-T. Poon, A. Donsig, B. Ventura, D. Pitts, T. Freeman, J. Orr, X. Dai, D. Larson, S.-C. Ong, J. Daughtry. D. Westwood, A. Lambert, W. Wogen, and R. Baker.

Multidimensional complex analysis and operator theory, NORBERTO SALINAS, University of Kansas, and HARALD UPMEIER, University of Kansas. Speakers were L. Coburn, A. Koranyi, Z. Yan, K. Stroethoff, R. Rochberg, H. Li, P. Muhly, A. Ramsay, K. Yan, M. Peloso, N. Salinas, S. Krantz, J. D'Angelo, D. Barrett, R. Curto, B. MacCluer, J. Fox, X. Wang, E. Park, and J. Kaminker.

Graph Theory, WARREN E. SHREVE, North Dakota State University, Fargo. Speakers were J. Hall, H. Harborth, T. Reid, M. Doob, D. Bange, A. Barkauskas, N. Dean, J. Hutchinson, A. Schwenk, J. Lundgren, J. Gallian, M. Jacobson, W. Kocay, P. Erdos, R. Grahaom, R. Schelp, G. Exbo, F. Chung, and R. Faudree.

The geometry of equilibrium configurations, ROBERT D. GULLIVER, University of Minnesota, Minneapolis, and HENRY C. WENTE, University of Toledo. Speakers were J. Nitsche, V. Oliker, R. Schoen, H. Shin, F. Sauvigny, R. Gulliver, F. Brulois, R. Finn, L.-F. Tam, N. Korevaar, I. Bakelman, U. Patnaik, S. Wei, and A. Treibergs.

Constrained approximation, theory and applications, VASANT A. UDHAYA, North Dakota State University, Fargo. Speakers were F. Deutsch, J. Ward, D. Townsend, R. Huotari, Y. Xu, A. Dontchev, P. Smith, J. Swetits, J. Borwien, A. Lewis, M. Best, and V. Ubhaya.

Ergodic theory, DOGAN COMEZ, North Dakota State University, Fargo. Speakers were K. Cogswell, J. Olsen, I. Kornfeld, M. Lacey, R. Jones, C. Silva, A. Tempelman, D. Rudolph, Q. Zhang, M. Rao, M. Lin, and C. Bose.

Lorentz transformations and spacetime geometry, ABRAHAM UNGAR, North Dakota State University, Fargo. Speakers were A. Das, R. Breheme, A. Ungar, P. Olver, K. Volpert, G. Martin, H. Gelman, G. Galloway, S. Harris, D. Sen, D. Sattinger, F. Tangherli, H. Wilhelm. D. Wilkins, F. Winterberg, and P. Parker.

Contributed Papers. There were two sessions of contributed ten-minute papers. The session on Algebra and Combinatorics was chaired by Eric Lund of Bemidji State University; four papers were presented. The session on Geometry and Analysis was chaired by Tim Piel of Moorhead State University; five papers were presented.

Committee. Joseph Brennan of North Dakota State University, Fargo, supervised local arrangements.

Andy R. Magid
Associate Secretary
Norman, Oklahoma

Miscellaneous

Personal

Chi-Wang Shu, of Brown University, has been promoted to Associate Professor at that institution.

János Tóth, of Gödöllő Agricultural University, Hungary, has been appointed head of the department of computer science at that university.

Deaths

N. Hansen Ball, of Annapolis, Maryland, died in December 1991, at the age of 84. He was a member of the Society for 61 years.

W.R. Hutcherson, Professor Emeritus of the University of Florida, died on July 2, 1991, at the age of 92. He was a member of the Society for 60 years.

Kotaro Oikawa, of Kanto Gakuin University, died on October 24, 1991, at the age of 62. He was a member of the Society for 33 years.

E.T. Parker, Professor Emeritus of the University of Illinois at Urbana-Champaign, died on December 31, 1991, at the age of 65. He was a member of the Society for 41 years.

Ross C. Talent, of Macquarie University, died on September 25, 1991, at the age of 31. He was a member of the Society for one year.

James C.S. Wong, of the University of Calgary, died on September 16, 1991, at the age of 50. He was a member of the Society for 23 years.

Hans J. Zassenhaus, Professor Emeritus of Ohio State University, died on November 21, 1991, at the age of 79. He was a member of the Society for 44 years.

Visiting Mathematicians

Supplementary List

Mathematicians visiting other institutions during the 1990-1991 and 1991-1992 academic years have been listed in recent issues of the *Notices*: January 1992, p. 61; December 1991, p. 1348; November 1991, p. 1192; October 1991, p. 1016; September 1991, p. 858.

Victor Goryunov (Russia), University of Hawaii, Manoa, Differential Geometry, 1/92–6/92.

Mikiya Masuda (Japan), University of Hawaii, Manoa, Topology, 12/91-8/92.

Zhenyuan Xu (People's Republic of China), University of Hawaii, Manoa, Partial Differential Equations, 1/92–6/92.

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Hendrix is a selective liberal arts college with approximately 1,000 students located in central Arkansas (30 miles north of Little Rock). The department consists of four full-time faculty.

Send curriculum vitae, three letters of recommendation (at least one discussing teaching), and graduate and undergraduate transcripts to Zeev Barel, Mathematics Search Committee, Hendrix College, 1601 Harkrider St., Conway, AR 72032. Evaluation of applicants will begin on April 6, 1992 and will continue until the position is filled. Hendrix College is an Equal Opportunity Employer and enthusiastically solicits applications from women and minorities.

CALIFORNIA

HUMBOLDT STATE UNIVERSITY (HSU)

Applications are invited for a tenure-track assistant or associate professor position for Fall 1992. HSU, located on the California north coast, has an active mathematics faculty and a strong undergraduate major with options in applied mathematics, computer science, and teacher preparation, as well as a master's program in mathematical modeling of environmental systems. Candidates must have a doctorate in statistics or a mathematical science with a strong background in statistics. All qualified applicants with a commitment to teaching excellence and scholarly activities will be considered. Preference will be given to applicants who can help meet programmatic needs in teaching undergraduate statistics and mathematics and who will take an active role in the graduate program in mathematical modeling. Women and minorities are especially encouraged to apply. Applicants should send vita, transcripts and three letters of reference to Search Committee, Department of Mathematics, Humboldt State University, Arcata, CA 95521 by March 27 for full consideration. HSU is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA
Riverside, California
Department of Mathematics

Applications are invited for one or several anticipated Visiting Assistant Professor positions beginning September 1992. Applicants must show strong promise in research and teaching. The teaching load is six quarter courses per year, with at least half of the courses at the sophomore level or higher. The positions are open to applicants from all research areas in Mathematics. Two of the anticipated positions have priorities: algebra (including algebraic geometry) for one, and topology for the other. Candidates should have received a Ph.D. degree by September 1992.

Applicants should send their **curriculum vitae, including their publication list, and have at least three letters of recommendation** sent to

Temporary Faculty Search Committee
Attn: Julie Martin, Admin. Asst.
Department of Mathematics
University of California, Riverside
Riverside, CA 92521-0135

by **April 15, 1992**. UCR is an Affirmative Action/Equal Opportunity Employer.

FLORIDA

UNIVERSITY OF FLORIDA
Department of Mathematics

We invite applications for one or more tenured or tenure-track appointments in mathematics, effective August 1992 (subject to budgetary approval). Junior candidates are expected to have made substantial research contributions beyond the doctoral dissertation. Senior candidates are expected to have demonstrated leadership in research. Applicants should forward a curriculum vitae, a list of publications, and a small number of reprints and/or preprints to

Chair of Search Committee
Department of Mathematics, University of Florida, Gainesville, FL 32611.

Candidates should supply evidence of commitment to teaching and arrange for at least three letters of recommendation to be forwarded.

UF is an Affirmative Action Employer, and the Department welcomes applications from women and minority candidates. Full consideration will be given to candidates whose materials arrive by April 1, 1992.

KANSAS

JOHNSON COUNTY COMMUNITY COLLEGE
Program Director

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MASSACHUSETTS

BOSTON UNIVERSITY
Department of Mathematics

The Department of Mathematics at Boston University invites applications for a position (pending final approval) in the area of Dynamical Systems. This position is tenure-track at the assistant professor level. The successful applicant should have a strong commitment both to research and teaching. Applications and 3 letters of reference should be sent to: Search Committee (Dynamical Systems), Department of Mathematics, Boston University, 111 Cummington St., Boston, MA 02215. AA/EOE.

UNIVERSITY OF MASSACHUSETTS

Tenure-track position at Assistant Professor level beginning September 1992 or January 1993. Our search will continue until the position is filled. Fields should complement departmental strengths in algebraic groups, algebraic geometry, complex manifolds, continuum mechanics, differential equations, differential geometry, lattice theory, number theory, numerical/computational mathematics, probability, topological groups and statistics. Preference given to applicants with both a strong research potential and excellent teaching skills. Send vitae, publication list, evidence of excellence in teaching and three letters of recommendation to David R. Hayes, Head, Department of Mathematics and Statistics, University of Massachusetts, Amherst, MA 01003. Should be received no later than April 7, 1992. Equal Opportunity/Affirmative Action Employer.

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NORTHERN MICHIGAN UNIVERSITY

The Department of Mathematics and Computer Science invites applications for a tenure-track position in computer science. A Ph.D. in computer science or a Ph.D. in mathematics with significant experience in computer science is required. All specialties will be considered. Interests in the department include: artificial intelligence, computer graphics, computational graph theory, theory of computing and mathematical software.

NMU is primarily an undergraduate institution, and a commitment to teaching is an essential expectation of the position. Research and professional activity are both encouraged and supported.

Applicants should send transcripts, three letters of recommendation and a resume to Dr. Terrance L. Seethoff, Department of Mathematics and Computer Science, Northern Michigan University, Marquette, MI 49855. NMU is an equal opportunity, affirmative action employer.

NEVADA

UNIVERSITY OF NEVADA, LAS VEGAS

The Department of Mathematical Sciences has one tenure-track position in Applied Mathematics at the junior level and one Lectureship. Both positions start Fall 1992. Preference may be given to candidates with research interests compatible with those of our current faculty. A Ph.D. in Mathematics/Applied Mathematics and a serious commitment to research and teaching are required for tenure-track positions. Lectureships are renewable one year appointments, and lecturers must have a master's degree in the Mathematical Sciences. Rank and salary will be commensurate with the candidate's experience and qualifications.

UNLV, a growing urban university with an enrollment of over 19,500 students, houses a National Supercomputing Center funded by the DOE.

Submit a letter of application, a current resume, photocopies of transcripts, four letters of reference, and if applying for the tenure-track position, an abstract of current research to the Search Committee, Department of Mathematical Sciences, University of Nevada, Las Vegas, Las Vegas, NV 89154. The processing of applications will begin March 31, 1992. Applications for unfilled positions will be accepted until May 1, 1992. Proof of Eligibility for U.S. Employment (under the Immigration Reform and Control Act of 1986) will be required prior to employment. The University of Nevada, Las Vegas is an equal opportunity/affirmative action employer.

NEW YORK

HUNTER COLLEGE
Department of Mathematics and Statistics

The Department seeks to fill a tenure-track opening at the level of Assistant Professor starting in fall 1992. The starting salary for an Assistant Professor at Hunter ranges from $26,630–$46,176. Candidates should present credentials indicating strong potential or an excellent record of accomplishment in both research and undergraduate teaching.

Applicants should send a vitae and at least 3 letters of recommendation to:

Professor Thomas Jambois
Department of Mathematics and Statistics
Hunter College, CUNY
695 Park Avenue
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STATE UNIVERSITY OF NEW YORK AT ALBANY, Department of Mathematics and Statistics, Albany, NY 12222. Applications are invited for a tenure-track position at the rank of Assistant Professor beginning September 1, 1992. Qualifications include a Ph.D., strong record and/or promise in research, and a strong record in and commitment to teaching. All research areas will be considered, but preference will be given to areas which complement the department's existing strengths. Please furnish a curriculum vitae, a description of research, and three letters of reference to R. Michael Range, Chairman, Department of Mathematics and Statistics. The University at Albany is an EOAA employer.

NORTH CAROLINA

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE
Department of Mathematics
Charlotte, NC 28223

Several tenure-track positions at Asst/Assoc/Prof level. Areas of preference are Probability, Statistics, Mathematical Physics, PDE/ODE, Dynamical Systems, Analysis, Commutative Algebra/Algebraic Geometry, Differential Geometry and Differential Topology. Strong candidates in other areas will also be considered. Possible visiting positions in all areas at any level or postdoctoral positions. Rank and salary depend on qualifications. Ph.D. and a serious commitment to teaching and research are required. Possible lecturer positions (non-tenure track, M.A. or M.S. required) also. Send vitae, list of 4 references, and abstracts of research to Alex Papadopoulos, Chair, Faculty Selection Committee, at the above address. Closing date: February 3, 1992, but all applications will be considered until the positions are filled.

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OREGON

SOUTHERN OREGON STATE COLLEGE
Department of Mathematics
Ashland, OR 97520

The Department of Mathematics anticipates two positions for the 1992-1993 academic year, both subject to funding approval. One position is a one year sabbatical replacement position that requires a Doctorate in Mathematics or Mathematics Education and the other is a one year position renewable to a maximum of three years and requires a Masters degree in Mathematics. Applicants must have a strong commitment to teaching undergraduate mathematics and have the equivalent of one year of college level teaching experience. Send applications by April

15, 1992 to Dr. John Whitesitt, Chair at the above address. SOSC is an AA/EEO employer.

VIRGINIA

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Department of Mathematics

Applications are invited for a tenure-track position in Geometry (differential or algebraic, or related areas) beginning Fall 1992. Because we seek applicants who will be able to develop a strong case for eventual promotion and tenure, preference will be given to those with postdoctoral or instructorship experience and established research programs. Please send vita and brief description of research and have three letters of reference sent to Prof. Frank Quinn, Chair, Geometry Search Committee, Department of Mathematics, Virginia Tech, Blacksburg, VA 24061-0123. Applications will be accepted until March 15, or until position is filled. Virginia Tech is an Equal Opportunity/Affirmative Action Employer. The University takes its affirmative action mission seriously and is especially interested in receiving applications from women and people of color.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Department of Mathematics

The department invites applications in the area of partial differential equations. Applicants should have a strong theoretical background in partial differential equations and a demonstrated interest in applications. We are particularly interested in applicants at the assistant professor level. Applicants should submit a curriculum vitae and list of publications and arrange three letters of recommendation to be sent to Michael Renardy, Chair, Applied PDE Search Committee, Department of Mathematics, Virginia Tech, Blacksburg, VA 24061-0123. Applications accepted until March 15, 1992 or until position is filled. Virginia Tech is an Equal Opportunity/Affirmative Action Employer. The University takes its affirmative action mission seriously and is especially interested in receiving applications from women and people of color.

HONG KONG

HONG KONG BAPTIST COLLEGE
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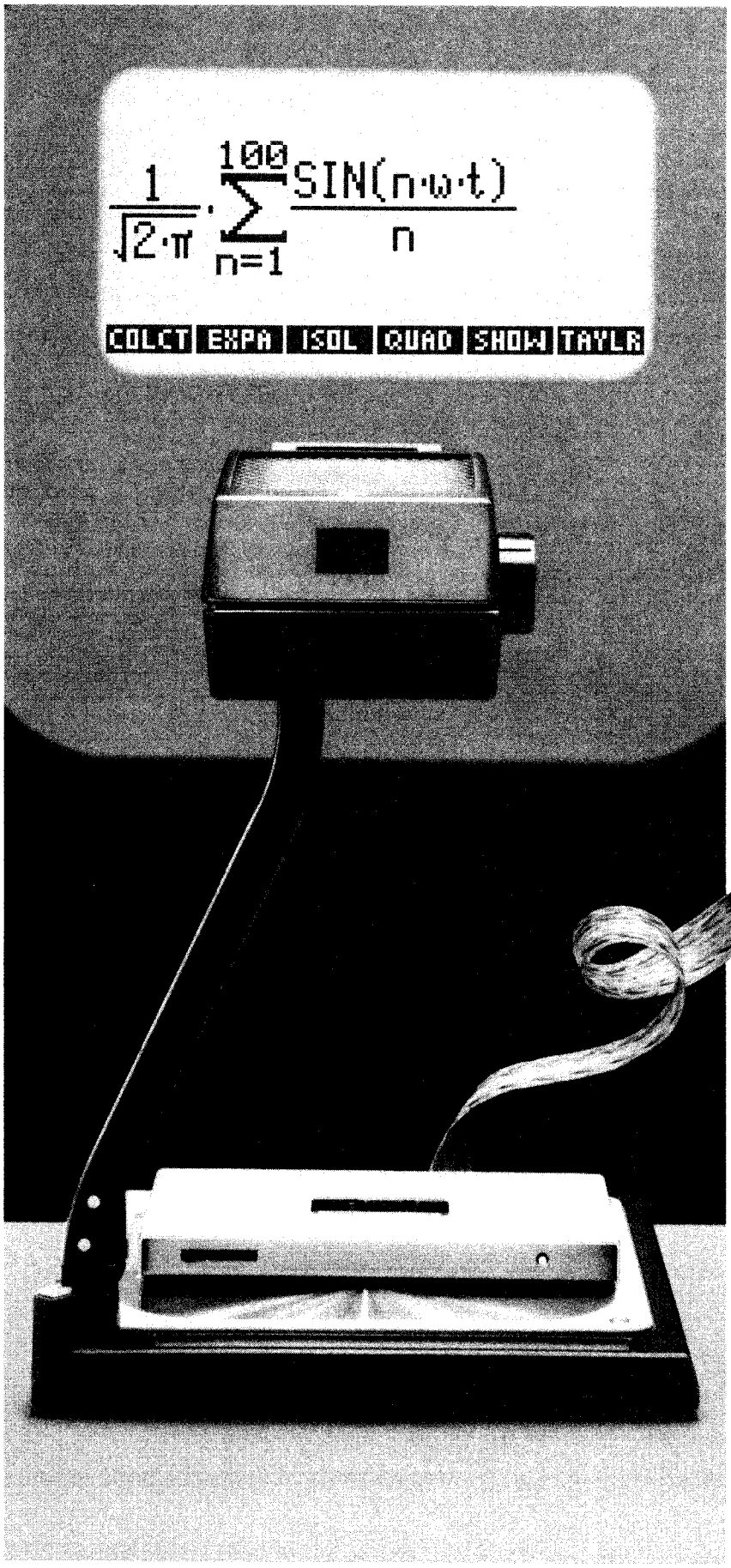

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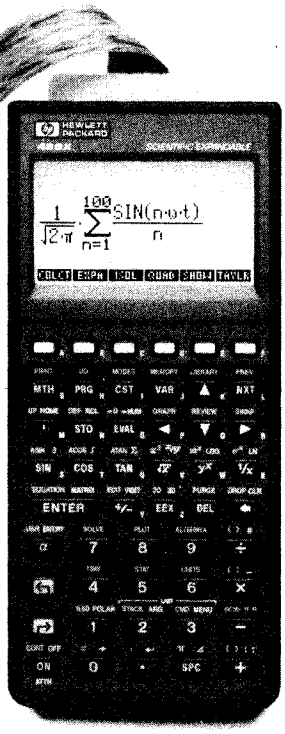

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An Open Letter to I. R. SHAFAREVICH

We are saddened by the numerous anti-semitic sentiments appearing in your work "Russophobia" and in your public comments on the current political situation.[1]

We have applauded your defense of individuals during the dark chapters of recent Russian history. We respect your profound and lasting contributions to mathematics. A mind capable of seeing the beauty of our discipline, a mind that can further our science, should also be able to see the emptiness, futility and absence of reason in the conspiratorial theory to which you subscribe.

Your espousal of long discredited allegations about the role of Jews in world history, and in particular about their role in Russian history, can only have a chilling effect on your interactions with Jewish and non-Jewish mathematicians and on the recently improved relations between East and West. Your writing can be used to give an intellectual foundation to a theory of hate that has in the past and can again in the future lead to mass murder.

We ask that you reassess your position and we urge a public disclaimer of your anti-semitic polemic.

Alphabetical list of signers as of 26 January 1992 follows. Institutional affiliation listed for identification only.

[1] The process of writing this letter and collecting signatures started in April of 1990. The passage of time has apparently NOT made this sentence obsolete even though there have been changes in the political situation.

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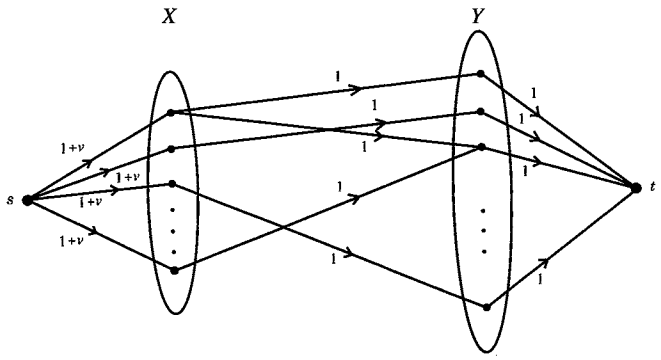

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