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Calendar of AMS Meetings and Conferences

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

Abstracts of papers presented at a meeting of the Society are published in the journal *Abstracts of papers presented to the American Mathematical Society* in the issue corresponding to that of the *Notices* which contains the program of the meeting, insofar as is possible. Abstracts should be submitted on special forms which are available in many departments of mathematics and from the headquarters office of the Society. Abstracts of papers to be presented at the meeting must be received at the headquarters of the Society in Providence, Rhode Island, on or before the deadline given below for the meeting. Note that the deadline for abstracts for consideration for presentation at special sessions is usually three weeks earlier than that specified below. For additional information, consult the meeting announcements and the list of organizers of special sessions.

Meetings

Meeting #		Date	Place	Abstract Deadline	Program Issue
859	*	August 8–11, 1990 (93rd Summer Meeting)	Columbus, Ohio	Expired	July/August
860	*	October 20–21,1990	Amherst, Massachusetts	August 6	October
861	*	November 2–3, 1990	Denton, Texas	August 6	October
862	*	November 10–11,1990	Irvine, California	August 6	October
863	* †	January 16–19, 1991 (97th Annual Meeting)	San Francisco, California	October 10	December
864	*	March 16–17, 1991	South Bend, Indiana	January 3	March
865	*	March 22–23,1991	Tampa, Florida	January 3	March
866	*	June 13–15, 1991	Portland, Oregon	March 26	May/June
867	*	August 8–11, 1991 (94th Summer Meeting)	Orono, Maine	May 29	July/August
868	*	October 12–13, 1991	Philadelphia, Pennsylvania	August 1	October
869	*	October 25–26, 1991	Fargo, North Dakota	August 1	October
870	*	November 9–11, 1991	Santa Barbara,California	September	November
871	*	January 8–11, 1992 (98th Annual Meeting)	Baltimore, Maryland	October 2	December
		March 27–28, 1992	Springfield, Missouri		
		March 13–14, 1992	Tuscaloosa, Alabama		
		June 29–July 1, 1992 (Joint Meeting with the London Mathematical Society)	Cambridge, England		
		January 13–16, 1993 (99th Annual Meeting)	San Antonio, Texas		
		August 15–19, 1993 (96th Summer Meeting) (Joint Meeting with the Canadian Mathematical Society)	Vancouver, British Columbia		
		January 5–8, 1994 (100th Annual Meeting)	Cincinnati, Ohio		
		January 10–13, 1996 (102nd Annual Meeting)	Orlando, Florida		

* Please refer to page 721 for listing of Special Sessions.

† Preregistration/Housing deadline is November 16

Conferences

August 2–3, 1990: AMS-SIAM-SMB Symposium on Some Mathematical Questions in Biology, Neural Networks, Vancouver, Canada.

August 6–7, 1990: AMS Short Course, Combinatorial Games, Columbus, Ohio.

Deadlines

	September Issue	October Issue	November Issue	December Issue
Classified Ads*	July 30, 1990	August 27, 1990	October 5, 1990	November 2, 1990
News Items	August 3, 1990	August 30, 1990	October 9, 1990	November 2, 1990
Meeting Announcements**	July 19, 1990	August 14, 1990	September 24, 1990	October 22, 1990

* 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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AMERICAN MATHEMATICAL SOCIETY

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666 Making Mathematics Work for Minorities *National Convocation Rallies Forces for Change*

Increasing the participation of underrepresented minorities in mathematics has gone beyond the issue of equity and has become a necessity for the continuing health of the science and engineering enterprise in this country. In this article, Allyn Jackson describes the discussions at a recent meeting at the National Academy of Sciences, during which participants examined the institutional, social, and attitudinal barriers to change.

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From the Executive Director ...

MATHEMATICS EDUCATION

As reported approximately a year ago in comments found on this page of *Notices*, new things are happening at the Society relative to mathematics education. At a recent meeting, I was involved in several discussions on "the role of the AMS in mathematics education." To put such discussions in perspective, I found it instructive to reflect on the purpose of the Society and how present issues and activities in mathematics education bear upon this purpose.

The purpose of the Society has been unchanged since its inception though the wording of that purpose has gone from "encouraging and maintaining an active interest in mathematical science" to "furtherance of the interest of mathematical scholarship and research." The latter appears in the text of incorporation of the Society in 1923 and remains as the stated purpose of the Society. How the Society carries out its activities and conducts its business within the framework of its purpose is reflected in the interpretation of that purpose by Society leadership and governing bodies. I would say the present leadership and governing bodies interpret the Society's purpose rather broadly in support of and service to the mathematical community.

The purpose of the Society and activities specific to mathematics education have been at issue before. The April 1915 Council voted that "It is deemed unwise for the American Mathematical Society to enter into the activities of the special field now covered by the *American Mathematical Monthly* . . ." What the Council of April 1915 went on to say is priceless: ". . . should an organization be formed to deal specifically with this work, the Society would entertain toward such an organization only feelings of hearty good will and encouragement." Of course, this is precisely what happened and this year we celebrate the 75th Anniversary of the Mathematical Association of America, which was founded at the meeting of the Chicago Section of the Society held in Columbus, Ohio in December 1915.

Today there is considerable public attention to issues in mathematics education from kindergarten through graduate school, and other professional mathematics organizations are working vigorously on mathematics education. But there seems to be a strong and recurring message in all of the present activity: the community commonly identified as being represented by the Society must be involved if mathematics education reform is to be complete and effective. Concern about the wisdom of the Society's entering such activities, as well as concern about the use of Society resources, continue to be raised. Compartmentalization and stratification within the community have led to issues of "turf." There will only be benefit to the community through the collective and cooperative actions of all the community; mathematics education reform and encouragement for those typically underrepresented in the study of mathematics can only be achieved through support for a strong and healthy research enterprise in mathematics; indeed, the furtherance of the interest of mathematical scholarship and research cannot be achieved without attention to issues of mathematics education.

To focus discussions of the AMS role in mathematics education and to direct Society action, the Executive Committee of the Council has recommended to the Council that a standing AMS Committee on Education be established. This Committee will provide a forum for the discussion of the full range of mathematics education issues facing the nation, including but not limited to, general mathematics education for K-12, undergraduate and graduate mathematics education, and the recruitment of young people and underrepresented groups into the profession. The Committee will recommend actions that will make a positive contribution to improving mathematics education and will communicate and coordinate these actions with the educational initiatives of other organizations.

Mathematics education involves difficult intellectual questions and is not merely a service activity. We must attempt to define and describe mathematics education in the broad professional role of the members of our community. Hopefully, we will develop a culture that will not have to ask "what is the role of a research mathematician in mathematics education?"

William Jaco

Letters to the Editor

Human Rights of Mathematicians in the U.S.S.R.

While the situation of Jews in the Soviet Union has changed considerably, and many more can leave, there is ample cause for alarm. Numerous newspaper reports of anti-Semitic incidents rouse concern. But not so well known is the continuation of certain discriminatory practices in academic circles—under glasnost and perestroika.

I recently learned about 4 mathematicians who were not granted Ph.D.'s by the Council of Mathematics and Mechanics of Moscow State University. This is Council No. 1, responsible for Analysis, Probability and Differential Equations. The people involved are (names in parenthesis are advisors): I. M. Belenkii, 1989 (Gorin); O. Immanvilov, 1986 (Fursikov); M. Blanc, 1986 (Sinai); and B. Shapiro, 1989 (Arnold).

In the last case, at the meeting of the council, the official opponent made only positive remarks about the thesis, and no one had anything negative during the ensuing discussion. Nevertheless when the (secret) vote was taken, then and there, the thesis was voted down. Later Arnold resigned from the council stating that he did not wish to serve with people who make decisions on other than scientific grounds.

It is clear to many of our Soviet colleagues that these four people were turned down because of anti-Semitism. Apparently it is common practice for the council—though not permissible according to its rules—to have "dead present voting". That is, if a member of the council is not present, and has not designated someone to vote for him or her, then the secretary apparently feels free to arbitrarily assign someone to do it.

Last fall, for the first time in many years, a good number of young Jewish students was admitted to study Mathematics at the University. I was told that the entrance examination system had been changed to be more fair and to reduce the incidence of discrimination. A welcome development! But I have just learned that the Mathematics examining committee recently voted to go back to the old system.

Louis Nirenberg
New York University
(Received May 14, 1990)

Mathematics Outside of Mathematics Departments

The depressing situation documented in the article 'Mathematics Outside of Mathematics Departments', by S. Garfunkel and G. Young, in the April 1990 *Notices* is, in my view, a symptom of deeper effects. While there has been in recent years much lip-service to the desirability of greater involvement of mathematics in science and engineering, there has not been a commensurate commitment of institutional energy and money. For example, my own field of Differential Geometry has had great intellectual success in fields such as Physics, Mechanics and Control — and I am now working on possibilities in Computer Science — but I do not see support by the mathematical world for development of courses, textbooks, research institutes, etc. to make available to students material they would need to understand the new and difficult mathematical insights. Instead, much of the activity which has taken place has been that of most concern and benefit to existing mathematical interests, or that has had publicity due to the entrepreneurial energy of certain players.

Robert Hermann
Brookline, Massachusetts
(Received April 23, 1990)

Graduate Education in Mathematics

With great interest I read the article by Allyn Jackson, "Graduate Education in Mathematics" (*Notices*, March 1990, page 266 ff). I wish to make some brief comments. First, what Ivar Stakgold has done is revive the discussion that led to the institution of the D.A. degree back in the late 60s and early 70s. Although he does not want to "revive" the D.A. (I didn't know it had fainted or died), he is nonetheless calling for the equivalent.

Second, I disagree with Jackson's remark that the D.A. "was created at a time when many feared a shortage of mathematicians to fill faculty vacancies". The D.A. was created for the very reason that Stakgold gives when he calls for a second track in the doctoral program.

Third, the reason the D.A. "never really caught on" was because there was some suspicion that the D.A.

Policy on Letters to the Editor

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

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

The committee reserves the right to edit letters.

Notices does not ordinarily publish complaints about reviews of books or articles, although rebuttals and correspondence concerning reviews in *Bulletin of the American Mathematical Society* will be considered for publication. All published letters must include the name of the author.

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

Letters should be mailed to the Editor of *Notices*, American Mathematical Society, P.O. Box 6248, Providence, RI 02940, and will be acknowledged on receipt.

wasn't the genuine article. This was (and is) an unfortunate suspicion. I will only say that D.A. mathematicians do continue to distinguish themselves as faculty members and scholars every bit as much as most Ph.D. mathematicians.

Don Muench
St. John Fisher College
(Received April 9, 1990)

This refers to the article, "Graduate Education in Mathematics" (*Notices*, March 1990, pages 266-268), highlighted on the issue cover.

There is a problem with the article, and a fundamental one: the title refers to education, while the text itself deals with training (subtitles: Traditional training, Postdoctoral training; phrases: students are still trained, Ph.D. training, research training, etc.) There is a difference; e.g., as in institute of higher education, I am an educator, as contrasted e.g. with sea-lion training, training in the maintenance and repair of the 1960 Dodge Monaco, teacher training college (see, for instance, the concise edition of the OED). It is impossible to train a mathematician (the result is not a mathematician), while it is sometimes possible to educate one - but one must know what one is doing.

I suspect that one of the main sources of the current problems with education, and higher education in particular, in the U.S.A. is this very confusion: schools confine themselves to providing training only, in lieu of an actual education; and the "educators" do not know the difference. For example, math anxiety is an infectious disease spread by bad teachers; and these very teachers were shortchanged, and provided with training only, instead of being educated.

My objection to the article is, therefore, not the choice of terms used, but a factual one: that the article really is concerned with training and not education; and, thus, contributes to the (un-addressed) problem rather than to its solution.

Otomar Hájek
Case Western Reserve University
(Received April 16, 1990)

Mentoring

For many years, young mathematicians have been able to get an early start on their own ideas, unlike some sister sciences where beginners in a laboratory work almost as laboratory assistants on the professor's problem, and where every publication has the lab directors name at the start–whether or not the idea came from the director. This is often the fate of Post-docs in these fields, while in mathematics a young Post-doc can pursue his own ideas with advice or stimulus as he deems best.

The November issue of *Notices*, prominently on the second page (1146), seems to argue that Post-docs in mathematics should be reduced to the condition of partial servitude common in other fields, and that each Post-doc needs a "mentor". But let the author (and others equally misinformed) note that mentor is a noun and not a verb. There can be no "mentoring".

Postscript: It has just now appeared that the otherwise excellent David II report, "Renewing U.S. Mathematics: A plan for the 1990s", from the Board on Mathematical Sciences, National Research Council, presents a related version of these unfortunate ideas. On page 64, the reprint speaks of work which "extends beyond the doctorate for additional training" (as if we were training TV repairmen or circus performers). Finally, page 66 mentions "mentoring". There is a better established activity, called "directing thesis work".

Saunders Mac Lane
The University of Chicago
(Received May 15, 1990)

Confidentiality

The Supreme Court, in a decision on a case against the University of Pennsylvania by the Equal Employment Opportunity Commission, has ruled that confidential scholarly assessments of the work of a candidate for tenure at a university must be disclosed to federal investigators.

This step is a clear violation of confidentiality, basic to the maintenance of racism, sexism, anti-Semitism, etc. at universities. In consequence, I will therefore take more care to be honest in my written evaluations so that all candidates for tenure, or new positions, will be accorded an equal opportunity. I recommend that my colleagues decline to respond to telephone inquiries about the "real" story about people for whom they have written letters when they are being given the opportunity to make racist, sexist, anti-Semitic, etc. comments "off-the-record".

I recommend this action as the only proper response to this attack on undemocratic behavior in our profession.

William J. Pervin
University of Texas at Dallas
(Received April 18, 1990)

Saunders Mac Lane (*Notices* Letters to the Editor, April 1990) recommends declining to write letters to universities about the work of candidates for tenure. This is in light of the Supreme Court's decision requiring disclosure of tenure review files to federal officers in an investigation by the EEOC. (UNIVERSITY OF PENNSYLVANIA, petitioner v. EQUAL EMPLOYMENT OPPORTUNITY COMMISSION. No. 88-493. Jan. 9, 1990.)

In its decision the court declined to "expand" the First Amendment right of academic freedom and declined to "create a new privilege against disclosure of peer review materials" that was not already created by Congress. Justice Blackmun wrote the opinion in the unanimous decision of a court that is not known as an avid supporter of affirmative action or of the civil rights movement.

Professor Mac Lane refers to the court's decision as a "violation of

confidentiality" and an "attack on academic freedom." However, the court did not provide criteria for selection of teachers nor prevent the university from using any criteria of its own other than that of sex, race or national origin. I was an active member of AAUP for many years defending academic freedom and I see no attack on it here.

As for a "violation of confidentiality" I would be suprised if Professor Mac Lane does not know that in many universities the "confidential" letters he's talking about may be seen by every tenured associate and full professor in the department. I have read many of them. They must be read by everyone on the tenure committee and everyone in the university that is involved in the tenure decision. How is it a "violation of confidentiality" if an additional few members of a duly constituted commission see them in a properly prepared case of alleged discrimination?

By law (with criminal penalties) no officer or employee of the EEOC may make public in any manner whatever any information obtained by the Commission prior to formal proceeding.

The importance of confidentiality must be weighed against the extremely high costs to the university and to society of racial and sexual discrimination.

It appears that the main reason for confidentiality is to assure candor. Justice Blackmun wrote, "we are not so ready as petitioner seems to be to assume the worst about those in the academic community. Although it is possible that some evaluators may become less candid as the possibility of disclosure increases, others may simply ground their evaluations in specific examples and illustrations in order to deflect potential claims of bias or unfairness. Not all academics will hesitate to stand up and be counted when they evaluate their peers."

I urge Professor Mac Lane to reconsider his decision not to write evaluations and his recommendation for others to follow suit.

(All quotations and references to laws are from West's Supreme Court Reporter, vol. 110 No. 7, Feb. 1, 1990.)

Jack Tull
The Ohio State University
(Received April 24, 1990)

I was very disappointed to read the letter by Saunders Mac Lane in the April 1990 issue of *Notices*, regarding the recent Supreme Court decision about the confidentiality of scholarly assessments of the work of tenure candidates.

I am sorry that Professor Mac Lane finds this unanimous decision of the Supreme Court, which was supported by the American Civil Liberties Union, to be an "attack on academic freedom". I thought that academic freedom referred to the right of professors to study and write about topics of their choice without fear of reprisal, and that the granting of tenure was intended to protect these individual rights. In other words, the principal constitutional defense of academic freedom is the protection of free speech by the First Amendment. The decision of the Supreme Court in no way compromised these rights. On the contrary, the decision reaffirmed the rights of individual scholars under the First and Fourteenth Amendments. That is, as a consequence of this decision, scholars in tenure-track positions should feel more confident that they can work on problems that they find interesting without fear that they will be punished later for reasons unrelated to the quality of their work. The Court's decision makes it more difficult for universities to reject tenure candidates because of reasons related to gender, race, etc. Moreover, this decision has a direct bearing on work in certain academic fields – consider the situation of a female historian or literary critic who wishes to base her work on feminist theory.

I am also, frankly, offended by the implications of Professor Mac Lane's claim that "confidentiality [is] basic to the maintenance of quality." Can evaluators not justify the assessments they make in letters about tenure candidates? Are their judgements based on criteria other than the quality of the candidate's work? Do they have something to hide? I don't believe so; I certainly hope not. But it is, in fact, the case that women and minorities are under-represented in mathematics: can we prove that we are not at fault?

Confidentiality does serve at least one goal: collegiality. Someone's feelings might be hurt by another's evaluation of his/her scholarly ability. Friendships might suffer. I can see how this might lead people to be less willing to write unfavorable letters of recommendation, knowing there was some chance that they might become public. (At this point, however, the decision of the Supreme Court only releases the letters to federal investigators for the Equal Employment Opportunity Commission in cases where they feel the letters are necessary to assess the validity of claims of discrimination.) But I claim, nevertheless, that the quality of universities will not suffer. It is easy to differentiate between a letter which lends unqualified support to a candidate and a letter which merely avoids saying anything detrimental. Top candidates will still get the top jobs and will still get tenure at the top universities.

I hope that Professor Mac Lane will reconsider his decision no longer to write letters about tenure candidates. These letters still serve important goals. They are a service to candidates as well as to universities. It would be unfortunate if the mathematical community were deprived of the benefits of his perspective.

Kevin R. Coombes
University of Michigan
(Received May 1, 1990)

1989 Annual AMS-MAA Survey

(Second Report)

Enrollments, Faculty Characteristics,
and Update on New Doctorates, Fall 1989

Edward A. Connors

Highlights

1. *The final (spring) count of new doctorates in the mathematical sciences records 419 U.S. citizens among the 919 recipients of doctorates granted by U.S. institutions from July 1, 1988 through June 30, 1989. These U.S. citizens account for only 46% of the new mathematical sciences doctorates awarded by U.S. institutions.*
2. *The number of U.S. citizens receiving doctorates in 1988-1989 is less than 60% of the comparable number for a range of years in the mid-1970s.*
3. *Women received 24% of the doctorates in mathematical sciences awarded to U.S. citizens. This is the largest percentage ever and a significant increase over the 20-21% awarded in the last six years. The 100 doctorates awarded to women U.S. citizens in 1988-1989 is exceeded only by the 102 awarded in 1980-1981.*
4. *Slightly less than 1.5% of the fall 1988 full-time faculty in the mathematical sciences, Groups I, II and III combined, retired or died by the fall of 1989. (See box on this page for descriptions of the groupings used in this Survey.) Slightly less than 1.75% of the fall 1988 full-time faculty in Groups M and B retired or died by fall 1989.*
5. *One-third of the current full-time faculty at departments that responded to the Survey will have died or reached age 65 by the year 2005.*
6. *A substantial portion of the upper division (junior/senior) mathematics majors are women: 46% in each of Groups M and B, 39% in Groups I, II and III combined.*

A first report of the 1989 Survey appeared in the November 1989 *Notices*, pages 1155-1188, with corrections in the December 1989 *Notices*, page 1372. It included a report on the 1988-1989 new doctorates, starting salaries, faculty salaries, and a list of the names and thesis titles of the 1988-1989 doctorates. A supplementary list of 1988-1989 doctorates appeared in the May/June issue of *Notices*.

The 1989 Annual AMS-MAA Survey represents the thirty-third in an annual series begun in 1957 by the Society. The 1989 Survey was under the direction of the AMS-MAA Committee on Employment and Educational Policy (CEEP), whose members were: Donna L. Beers, Morton Brown, Stefan A. Burr, Edward A. Connors (chair), Philip C. Curtis, Jr., David J. Lutzer, and James J. Tattersall. The questionnaires were devised by CEEP's Data Subcommittee whose members were: Edward A. Connors (chair), Lincoln K. Durst (consultant), John D. Fulton, James F. Hurley, Charlotte Lin, Don O. Loftsgaarden, David J. Lutzer, James W. Maxwell (ex officio), Donald E. McClure, and Donald C. Rung. As of January 1990 the subcommittee became a standing AMS-MAA committee. Comments or suggestions regarding the Annual Survey may be directed to members of the new AMS-MAA Data Committee.

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

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

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

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

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

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

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

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

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

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

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

I. Introduction

We present several items of general and specific interest to the mathematical community and its observers. Our analysis is based on the data gathered in the 1989 Annual AMS-MAA Survey. As is customary we begin with an update on the employment status of the 1988-1989 class of new doctorates in the mathematical sciences. We then turn our attention to some of the information obtained from the departmental responses to the Departmental Profile Survey, and to the distribution of faculty by age section of the Faculty Status Survey. The data on faculty age is a new feature which we intend to repeat on a regular basis, perhaps biennially. We have discontinued our collection and analysis of faculty flow and mobility data (to the delight, undoubtedly, of numerous departmental assistants, heads, chairs, and, to be sure, of this author).

As in last year's report, we choose not to extrapolate from the raw data and thus we do not provide estimates of various faculty populations or course enrollments. Instead, we focus on faculty retirement and death rates (Table 3A), faculty composition by sex (Tables 3B and 3C), percentage change in faculty composition (Tables 3D and 3E), faculty age distribution (Table 3F and Figures 1-6), percentage changes in enrollments from fall 1988 to fall 1989 (Tables 4A and 6), undergraduate enrollment distribution patterns (Table 4B), percentages of women among junior/senior mathematics majors and graduate students (Tables 5 and 7), and percentages of U.S. citizens among graduate students (Table 8). The 1990 Survey of the Conference Board on the Mathematical Sciences (CBMS) will provide hard estimates of various faculty populations and course enrollments in the mathematical sciences, based on data gathered for fall 1990.

Finally we direct your attention to the information on response rates at the end of this report, and to the bibliography, which is a comprehensive and current compendium of references on data sources and recent reports in the mathematical sciences, science and engineering.

II. Update on the 1988-1989 New Doctorates

In the First Report of this Survey (November 1989 issue of *Notices*, pages 1155-1168) we reported a fall count of 904 new doctorates in the mathematical sciences granted by U.S. universities (since then increased to 905 because of a late departmental correction). We now update the fall counts to produce the 1988-1989 spring counts: 919 doctorates in the mathematical sciences awarded by U.S. institutions, and 62 awarded by Canadian institutions. Fall and spring counts for the last five years are given in Table 1.

Of the 919 doctorates awarded by U.S. universities, citizenship status was reported as known for 896, 419 of whom were U.S. citizens (319 men and 100 women). The 62 Canadian doctorates went to 54 men and 8 women.

TABLE 1: New Doctorates, Fall and Spring Counts

	84-85		85-86		86-87		87-88		88-89	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
U.S.	732	765	756	782	779	808	804	828	905*	919
Canada	37	42	45	45	66	66	52	55	53	62
Total	769	807	801	827	845	874	856	883	958*	981

*Increased from the fall count reported in the November 1989 *Notices*.

Employment data for new doctorates are updated in Tables 2A, 2B and 2C. We do not, however, include the additional new doctorates in our updated employment matrices. 18% of the new doctorates reported taking foreign academic or nonacademic employment (compared to 20% for 1987-1988 doctorates). By spring 1990 7% of new doctorates were either not seeking employment, were not yet employed, or their status was unknown (compared with 5% for 1987-1988 doctorates in the spring of 1989). 11.5% of the new doctorates were hired by Group B institutions (compared with 8% for 1987-1988 doctorates, and an average of 8.6% for the previous six years).

The research fields of the new doctorates continue to have an applied flavor (see Table 2C). For the last seven years half, or nearly half, of the new doctorates specialized in statistics, applied mathematics, operations research or computer science. 27% of the 1988-1989 new doctorates reported statistics as the field of thesis.

Finally, we note that the names of the 1988-1989 new doctorates and their thesis titles were published in *Notices* (November 1989 issue and a supplemental list in the May/June 1990 issue).

III. Faculty Characteristics

Two separate surveys provide the data reported in this section. Tables 3A through 3D are produced by responses to the Departmental Profile Survey conducted in fall 1989; Table 3F and Figures 1-5 are produced by responses to the Faculty Status Survey conducted in spring 1989.

In Table 3A we provide the attrition rates of full-time faculty in the mathematical sciences. The numbers we report are obtained from the departmental response to our request for the number of full-time faculty in fall 1988 as well as the number of these who had permanently retired or died by fall 1989. Note the differences among Groups I, II and III (comparable rates in last year's report were 1.26%, 1.65% and 1.76% respectively). Groups I, II and III combined yield a rate of 1.43% (compared to 1.57% last year). The 1.72% for Groups M and B combined is the same as last year's rate.

In last year's report we promised to "ascertain more information on age distribution of full-time faculty and thus better analyze the greying of the contemporary mathematical sciences faculty". Our data for 1989 are

TABLE 2A: Employment Status of 1988–1989 New Doctorates in the Mathematical Sciences

Type of Employer	Algebra and Number Theory	Real and Complex Analysis	Geometry and Topology	Logic	Probability and Statistics	Applied Mathematics	Discrete Mathematics and Combinatorics	Numerical Analysis	Linear and Nonlinear Optimization	Other	Total
Group I	15	32	24	8	4	18		3		3	107
Group II	8	8	7	2	5	14	2	1	1		48
Group III	11	11	4		10	8	1	5	1	3	54
Group IV	1				32						33
Group V					4	7			1	2	14
Masters	8	18	9	2	14	21	4	3	1	3	83
Bachelors	21	21	15	1	19	9	12	1	2	9	110
Two-year Colleges	2	1	2		1	2		1			9
Other Academic Departments	2		3		25	13	2	5	8	12	70
Research Institutes	3	2	8		6	3		2		2	26
Government	1	1			9	6			1	1	19
Business and Industry	1	4	5	4	48	17	1	3	9	8	100
Canada, Academic	2	8	1		12	2	4	1			30
Canada, Nonacademic			1		2	4					7
Foreign, Academic	19	23	20	1	41	28	7	4	6	6	155
Foreign, Nonacademic		2	2	1	5	5		1	3	3	22
Not seeking employment	1	1	3		3	2	1	2			13
Not yet employed (Spring 1990)	3	2	4	1	9	4		2	1	3	29
Unknown	2	8	3	2	8	2		3		1	29
Total	100	142	111	22	257	165	34	37	34	56	958

TABLE 2B: Employment Status of 1988–1989 New Doctorates in the Mathematical Sciences Females Only

Type of Employer	Algebra and Number Theory	Real and Complex Analysis	Geometry and Topology	Logic	Probability and Statistics	Applied Mathematics	Discrete Mathematics and Combinatorics	Numerical Analysis	Linear and Nonlinear Optimization	Other	Total
Group I	1	3	1	2	1	1					9
Group II	1	3	2	1	1	2					10
Group III	2		1		2			1	1		7
Group IV					8						8
Group V					1	2				1	4
Masters	2	5	2	1	4	5	1				20
Bachelors	6	3	5		4	8	7			5	38
Two-year Colleges	2	1			1						4
Other Academic Departments					7	3		1	2	1	14
Research Institutes		1			1	1					3
Government					2	1					3
Business and Industry			2		15	1		1	3		22
Canada, Academic			1		3						4
Canada, Nonacademic											
Foreign, Academic		3	5		7	4				1	20
Foreign, Nonacademic											
Not seeking employment			3		1						4
Not yet employed (Spring 1990)		1	1		5			1			8
Unknown					1					1	2
Total	14	20	23	4	64	28	8	4	6	9	180

Table 2C: Fields of New Doctorates

	Year Surveyed					
	1983–1984	1984–1985	1985–1986	1986–1987	1987–1988	1988–1989
Number (Fall Count)	789	769	801	845	856	958
Specialty:						
Applied Math	110 (14%)	115 (15%)	149 (19%)	142 (17%)	142 (17%)	165 (17%)
Statistics	173 (22%)	189 (25%)	171 (21%)	182 (22%)	173 (20%)	257 (27%)
Operations Research	66 (8%)	41 (5%)	62 (8%)	51 (6%)	59 (7%)	34 (3%)
Computer Science	20 (3%)	15 (2%)	16 (2%)	18 (2%)	16 (2%)	37 (4%)
Total	369 (47%)	360 (47%)	398 (50%)	393 (47%)	393 (46%)	493 (51%)

presented in Table 3F and, in graphical form, in Figures 1-5. Similar data for the years 1975 and 1985 for academic Ph.D. scientists and engineers are presented in Figure 6. See also [27] page 64, Figure 5.9, and page 117, Figure A5.9.

Table 3A: Faculty Attrition*

Group	Full-time Faculty
	%
I	.96
II	1.40
III	1.88
I+II+III	1.43
IV	1.33
V	.73
M	1.75
B	1.69
M+B	1.72

*Percentage of full-time faculty who were in the department in fall 1988 but were reported to have retired or died by fall 1989.

Table 3B: Percentage of Women among Doctoral Full-time Faculty, fall 1989

Groups							
I	II	III	I+II+III	IV	V	M	B
%	%	%	%	%	%	%	%
5.7	7.4	8.0	7.0	11.3	6.8	13.1	16.9

Table 3C: Percentage of Women among all Full-time Faculty, fall 1989

Groups							
I	II	III	I+II+III	IV	V	M	B
%	%	%	%	%	%	%	%
6.5	9.5	12.5	9.5	12.0	6.8	20.0	25.0

Our graphs in Figures 1-5 use 10-year intervals based on age 30, but the raw data are in 5-year spans. Some of the following comments are based on the raw data, which are available for each survey group. Groups I and V have by far the largest percentage of faculty age 35 or less (25%). The under-30 cohort accounts for 9% of the total faculty in Group I, and 6% in Group V. Group I has the largest percentage of faculty over 60 (13%). In fact, all 5-year age spans from 35-on for Group I hover around 13%, with the largest being 14% in the 45-50 age group. However, this age group (part of the silent generation) accounts for nearly 20% of the total faculty in each of the other survey groups and, indeed, in all survey groups combined. Groups I and V have nearly one quarter of their faculty at age 55. For all groups combined slightly more than one third of the total faculty is age 50 or older and thus will have either died or reached the age of 65 by the year 2005. Likewise, for all groups combined, slightly less than one fifth of the total faculty is age 55 or older.

Table 3D: Percentage Change in Doctoral Nontenured Faculty, fall 1988 to fall 1989

	Groups						
	I	II	III	I+II+III	M	B	M+B
	%	%	%	%	%	%	%
Male	+16	+10	+10	+12	+3	--	+1
Female	+96	+15	+7	+24	+17	+9	+13
Total	+21	+11	+10	+14	+5	+2	+4

Table 3E: Percentage Change in Doctoral Tenured Faculty, fall 1988 to fall 1989

	Groups						
	I	II	III	I+II+III	M	B	M+B
	%	%	%	%	%	%	%
Male	-3	--	-7	-4	+3	+3	+3
Female	-6	--	-3	-4	+7	+2	+4
Total	-3	--	-7	-4	+3	+3	+3

In Figure 3 and Table 3F we provide the age distribution of female faculty in all survey groups combined. Note that only 15% of the female faculty is age 55 or older and that the age 40-45 cohort, at 18% of the total, is the largest (and, in particular, is larger than the 45-50 age group). In Tables 3B and 3C we provide percentages of women among full-time faculty, for doctoral faculty and all faculty respectively.

Table 3F: Age distribution of mathematical sciences faculty, all groups*

	Total Faculty %	Male % of total males	Female % of total females
Under 30	5	5	8
30-35	12	12	15
35-40	13	13	16
40-45	16	15	18
45-50	20	20	15
50-55	15	16	13
55-60	11	11	8
Over 60	8	9	7

* The use of 5-year intervals in this table and 10-year intervals in Figures 1-5 results in slight differences because of rounding.

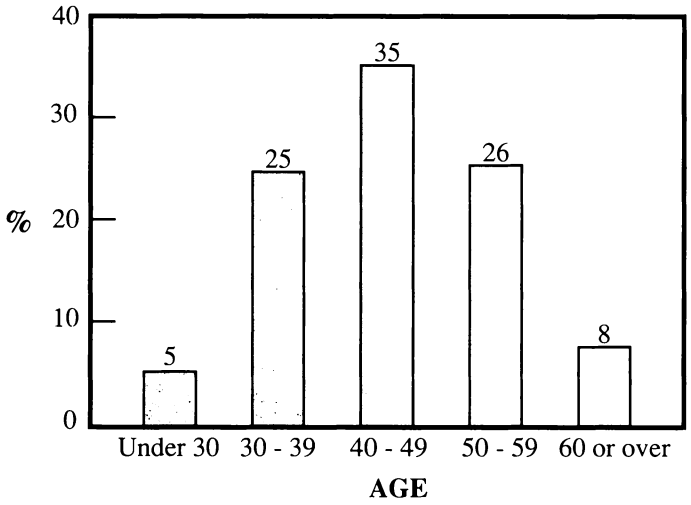

Figure 1. Age distribution of mathematical sciences faculty, all groups.

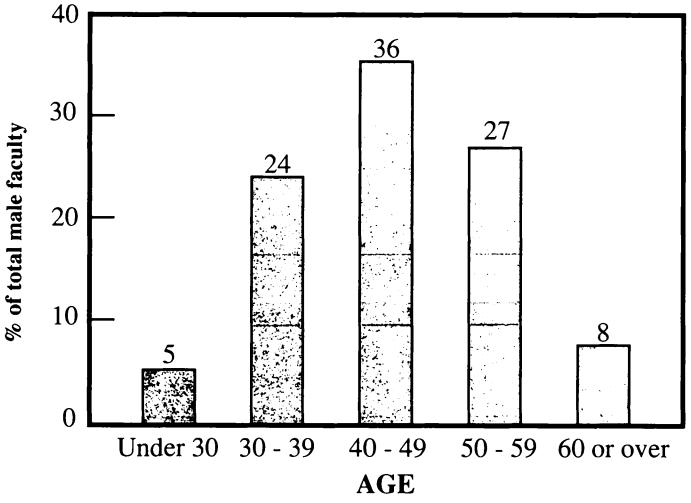

Figure 2. Age distribution of male mathematical sciences faculty all groups.

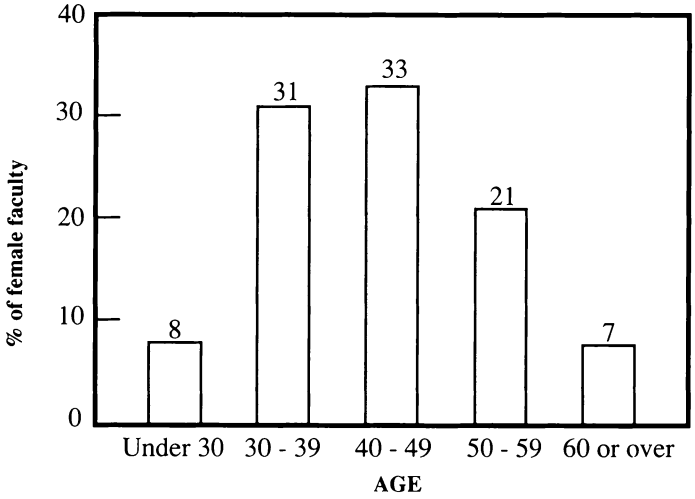

Figure 3. Age distribution of female mathematical sciences faculty, all groups.

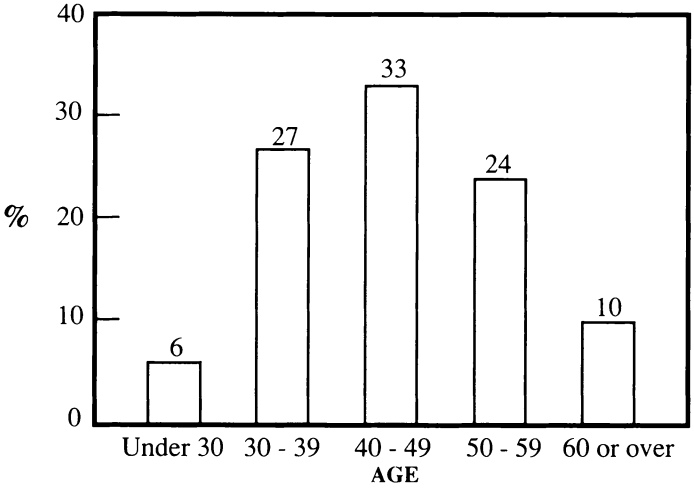

Figure 4. Age distribution of mathematical sciences faculty, Groups I, II, III.

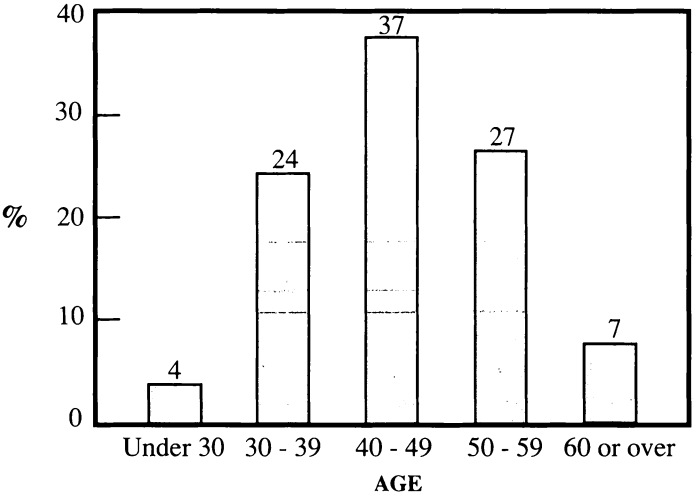

Figure 5. Age distribution of mathematical sciences faculty, Groups M and B.

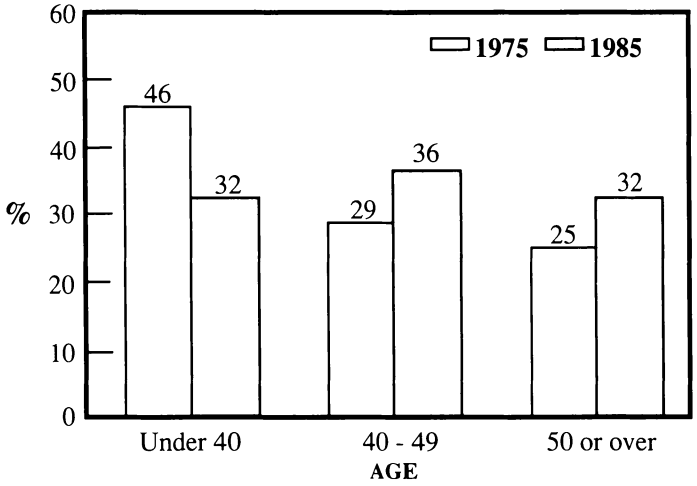

Figure 6. Age of Academic PhD Scientists and Engineers, 1975 and 1985. (Source: Commission on Professionals in Science and Technology Occasional Paper 89.3. Data Source: National Science Foundation)

IV. Undergraduate Enrollment Profile and Majors

The data in Table 4A are based on fall 1988 and fall 1989 enrollments reported on the 1989 Departmental Profile survey form, which requests two years' data on enrollments and departmental size. In particular, the comparisons in Table 4A are from the same set of respondents and do not use the results of last year's Annual Survey.

Table 4A: Percentage Change in Undergraduate Enrollments, fall 1988 to fall 1989

Groups				
I	II	III	M	B
-1%	-1%	0%	+3%	+3%

Table 4B: Undergraduate Enrollments Distribution, fall 1989

Group	Remedial Mathematics*	Remedial Mathematics + Pre-calculus	Remedial Mathematics + Pre-calculus + 1st-yr. Calculus
	%	%	%
I	9	24	60
II	7	28	59
III	11	35	58
I+II+III	10	31	59
M	15	33	49
B	19	35	49
M+B	17	34	49

*Arithmetic, high school algebra, geometry.

Table 5: Percentage of Women among Junior/Senior Majors (including double majors), fall 1989

Groups							
I	II	III	I+II+III	IV	V	M	B
%	%	%	%	%	%	%	%
36	41	42	39	43	28	46	46

V. Graduate Enrollments in the Mathematical Sciences, Sex and Citizenship

The data in Table 6 are based on fall 1988 and fall 1989 enrollments reported on the 1989 Departmental Profile survey form, which requests two years' data on enrollments and departmental size. In particular, the comparisons in Table 6 are from the same set of respondents and do not use the results of last year's Annual Survey.

We report a large drop of 15% from fall 1988 to fall 1989 in first-year full-time graduate students in Group I, but a large increase of 21% in Group III. For Groups I, II and III combined the numbers of full-time graduate students increased by 3% for first-year students, and 4% for all years.

Table 6: Graduate Students Percentage change, fall 1988 to fall 1989

	Groups				
	I	II	III	I+II+III	IV
	%	%	%	%	%
First year, full-time	-15	+8.4	+21	+3	-9
All years, full-time	-1	+8	+7	+4	+1

Table 7: Percentage of U.S. Citizen Women among U.S. Citizen Graduate Students, fall 1989

	Groups						
	I	II	III	I+II+III	IV	V	M
	%	%	%	%	%	%	%
First year, full-time	23	34	39	32	46	21	46
All years, full-time	22	30	36	29	46	20	45

Table 8: Citizenship of Graduate Students, fall 1989*

	Groups				
	I	II	III	IV	M
	%	%	%	%	%
First year, full-time	53	58	58	56	77
All years, full-time	50	53	59	47	74

*Percentage of U.S. citizens among graduate students whose citizenship is reported as known.

USEABLE RESPONSES

Survey	Groups I %	II %	III %	IV %	V %	VI %	M %	B %
Departmental Profile*	92	81	80	75	23	59	54	44
Faculty Age	64	84	87	69	32	69	57	43

* There are 4 parts to the Departmental Profile form (Enrollments, Majors, Departmental Size, and Graduate Students). The number given is the percentage of returns with a useable response on the departmental size.

Acknowledgement

The Annual AMS-MAA Survey attempts to provide an accurate appraisal and analysis of various aspects of the academic mathematical scene vital to the entire mathematical community. Yearly, collegiate departments in the United States, and the doctorate-granting departments in Canada, are provided the opportunity to respond. The quantity and quality of the responses directly determine the quality of the information in these reports. Without the dedicated cooperation of the secretarial and administrative support staff in the mathematical science departments we would not be able to conduct a survey, nor be confident in our analysis of its results. We are, unfortunately, unable to thank personally all the departmental assistants for their cooperation, but it is nonetheless appreciated. However, we are able to thank the administrative support staff of the AMS, especially Marcia Almeida, Monica Foulkes, and James W. Maxwell, whose efforts are acknowledged and appreciated.

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NOMINATIONS FOR THE 1991 SATTER PRIZE

In 1990, the American Mathematical Society established the Ruth Lyttle Satter Prize in Mathematics (see page 584 of the May/June 1990 issue of the *Notices*). The Satter Prize is to be awarded in odd-numbered years and will recognize an outstanding contribution to mathematics research by a woman in the previous five years. The first Satter Prize will be awarded at the Joint Mathematics Meetings in San Francisco in January, 1991.

The Committee to Select the Winner of the Satter Prize for 1991 (Joan Birman, Columbia University; Linda Keen, Herbert H. Lehman College of the City University of New York (chair); and Karen Uhlenbeck, University of Texas at Austin) is seeking nominations and suggestions from members of the mathematical community.

Nominations should include the candidate's name, affiliation, field of research, and a description of the work for which the prize would be awarded. This material should be sent to
Robert M. Fossum, Secretary of the AMS,
Department of Mathematics, University of Illinois, 1409 W. Green Street, Urbana, IL 61801
Nominations must be received by ***September 30, 1990.***

Making Mathematics Work for Minorities

National Convocation Rallies Forces for Change

A booklet about the history of the National Academy of Sciences building in Washington, DC has on its cover a picture of the Academy members of 1925, standing in front of the building. One wouldn't necessarily notice that the group is all white and all male, because that's usually what scientists look like; in fact, the 1990 membership of the prestigious Academy is not much different in composition. But when the booklet was included among the materials for a convocation entitled "Making Mathematics Work for Minorities," held at the Academy in May, the photo elicited a few ironic smiles.

As the song goes, the times they are a-changing. The convocation, sponsored by the Academy's Mathematical Sciences Education Board (MSEB), reflected a sense of unity and urgency among the participants. With representatives from industry, government, and education from forty states, this active and motivated group said that change is needed not only to break the low expectation-low achievement cycle of minority students in mathematics, but also to forestall a workforce crisis in science and technology. The convocation capped a series of six regional workshops, which produced a 27-page list of recommendations for change.

The convocation had a distinctly different flavor from most meetings one might find at the Academy, partly because of the racial mix of the 500 participants, and partly because of the activities on the program. From the Native American prayer in the opening invocation, to the Native American dancing after the banquet that evening, to the inspiring "invocation in song" during the recognition luncheon the following day, the convocation successfully meshed the academic and the cultural.

Demographics Tell All

The sense of urgency at the convocation was fueled by the perception that increasing the representation of minorities in science and technology is no longer a question of justice and equity. Speaker after speaker emphasized that the nation must develop the mathematical and scientific talent of minority youth, because the traditional pool of white males is simply not large enough. "We need to get away from the myth that this is an affirmative action issue," said Jaime Oaxaca, Vice-Chairman of Coronado Communications Corporation. "It's demographics."

According to a position paper by Shirley McBay, dean for student affairs at the Massachusetts Institute of Technology, minority Americans will fill 56% of all new jobs between 1986 and the year 2000. "These new workers will not only require better education in schools," she wrote, "but in college as well, for in the year 2000 half of all jobs will require some college, and 30% will require a Bachelor's degree." By the year 1996, she notes, there will be 45,000 fewer students with mathematics and science B.A.s than the nation will need to maintain its present economic status.

Connections to Social Ills

The urgency was also heightened by an acute awareness of the massive social problems connected to the educational issues. Poverty, drug abuse, violence in the schools, malnutrition, single-parent households, teen-age pregnancy, despair—such factors conspire to reduce educational opportunities for minorities. In her paper, McBay gave some sobering statistics: 15% of all black students and 36% of all Hispanic students drop out of high school; 50% of the 1987 high school graduates could not read well enough to master moderately complex tasks; and half of American 17-year-olds cannot handle junior high school-level mathematics problems.

Robert Chase, vice-president of the National Education Association, said he was somewhat disappointed that recommendations from the regional workshops did not mention such problems as poverty, drug abuse, and crime. The educational recommendations were sound and he did not expect a sociological treatise, he said, but minority achievement in mathematics is fundamentally tied to such issues as medical help, preschool education, and prenatal care. "School reform demands social reform," he stated simply. "You just can't have one without the other."

Robert M. Neilsen, assistant to the president for higher education of the American Federation of Teachers

(AFT), acknowledged the social problems, but said, "You can't wait to solve the big social issues. You've got to do what you can in the classrooms today, with the teachers and students you have." Neilsen, who has a Ph.D. in mathematics but left academia for the AFT some years ago, said that, at a school he visited in Texas, minority students were excelling in mathematics, as a result of changes in the curricula and the educational system. And in a neighboring town, he said, education reforms were actually leading social reforms. "There are hundreds of programs out there, and they all work," he said. "Don't wait for the perfect program. There are things you can do right now." Neilsen described these and other programs in "Anyone Can Learn Math: New Programs Show How," in the Spring 1990 issue of *American Educator.*

Attitude Change Needed

Many speakers declared that change in minority achievement will not come without a change in attitude, for the idea that minorities simply lack the ability to learn mathematics is still prevalent. For example, Neilsen's article prompted a letter from Julian Stanley, professor of psychology and head of the Study of Mathematically Precocious Youth at Johns Hopkins University. Calling the tone of the letter "sarcastic," Neilsen stated that "[Stanley] basically said these 'miracle programs' come and go, we've heard it all before, these programs don't withstand evaluation. The letter really knocked the programs and said it just isn't true that anyone can learn mathematics."

Another problem is that teachers often expect minority students to do poorly. Lacking the necessary motivation and self-esteem, these students fall into a cycle of failure and are sometimes blamed for their circumstances. Several speakers decried the use of "tracking," in which students are sorted according to ability. Often minority students are steered into the lower tracks, where instruction is poorer, expectations are lower, and opportunities for moving ahead are few. And several speakers noted that, despite desegregation, minority schools still lag in resources and trained teachers. "When 'white flight' occurred, they took their standards and their expectations with them," as one speaker put it.

Changes in curricula may help to address some of these problems. Mathematics must be taught in such a way as to relate to the lives of the students and to their cultural background, many speakers said. "People have to see themselves in what they do," said Charles Merideth, president of New York City Technical College of the City University of New York. He cautioned against "bastardizing" the subject (he joked about using a rap lyric in class: "The square root of 16 is 4/Hey, bro, close the door"), but saw a need to relate the subject to the students' lives, "to make mathematics breathe for them."

Anita McDonald, dean of the Evening College at the University of Missouri–St. Louis, pointed out the importance of shifting the emphasis of mathematics curricula. "We need to incorporate the achievements of African-Americans into the teaching of mathematics," she noted. "Mathematicians tend to think this is the task of mathematics educators, and they want to deal only with the 'pure' subject matter." Merideth suggested that, for example, discussing the mathematics of the Egyptians would help students to see that blacks are not "genetically incapable" of learning mathematics—a stereotype that some students have internalized.

The premise that all students can learn mathematics will require a restructuring of curricula to move away from rote learning and remediation, noted J. Arthur Jones, president of Futura Technologies, Inc. and chair of the steering committee for the Making Mathematics Work for Minorities project. Many speakers referred to the recent reports, "Everybody Counts," "Curriculum and Evaluation Standards for School Mathematics," and "Reshaping School Mathematics," all of which call for greater emphasis on applications and real-world problems, less rote learning and memorization, and a more student-centered approach to teaching. Some suggested that these reports could help in revising curricula in ways that would benefit all students, and minority students in particular.

Neilsen said that some minority schools have made curricular innovations that could be useful in other schools as well. He suggested that educational reform be centered at urban minority schools, where the need is the greatest. If those schools began to see improvements, the suburban schools would "scramble" to get their hands on the new curricula. The idea of starting in the suburban schools and allowing curricular reform to "trickle into" the urban schools would not work, in Neilsen's opinion.

Changes in Higher Education

Although the convocation emphasized precollege mathematics, there were specific suggestions for higher education. Uri Treisman, E. M. Lang Visiting Professor of Mathematics and Social Change at Swarthmore College, said that higher education has to get its own house in order and admit that "we've been an enormous failure." His statistics make a persuasive case. In 1988, out of about 100,000 non-Asian students of color in the California State University system, only eight received bachelor's degrees in science and mathematics. In a study of ten four-year liberal arts colleges, black students' calculus grades averaged 1.7 out of 4.0, and averages in the 1.0-1.5 range are common in public institutions. Mathematics departments have created a series of courses called "precalculus" that do not work, he said, noting that out of 422 students at U.C. Berkeley who

took precalculus, only one survived to get better than a C+ three years later in the calculus course designed for mathematics and science majors. "Data of that kind means nobody has looked seriously at this problem," he remarked. "It's unbelievable that no one has noticed the magnitude of our failure."

Mathematics departments need to evaluate who is making good use of mathematics courses and majors, he said. "Half a million students take calculus each year, a subject that by any standard is one of the great intellectual achievements of Western civilization," he declared. "It's a great subject, it drips with power. But how many students are impressed with it? How many say, 'Wow!'?" And why are minority students especially prone to failure in such courses? Mathematics faculty members have to approach such problems with an empirical, investigative spirit, Treisman says. "It can no longer be a personal mission of an individual faculty member," he remarked. "It has to be a departmental mission."

The recommendations coming out of the regional workshops formed the basis of discussions during the convocation, which in turn resulted in an outline for a "Ten-Year Plan" for improving the mathematics achievement of minorities. According to Beverly Anderson, director of minority programs at MSEB and professor of mathematics at the University of the District of Columbia, the Ten-Year Plan contains recommendations for every sector and educational level. For example, the news media can inform the public of the urgency of the problem and counteract stereotypes that minorities cannot succeed in mathematics. Communities are called upon to develop local coalitions for mathematics education, and professional organizations are asked to disseminate recent mathematics education reports. The Plan also calls for improvements in teacher education and retraining. A report containing the Ten-Year Plan will be issued to the convocation participants.

Reactions of Participants

Participants seemed to find the convocation useful in drawing attention to the problem of underachievement of minority students. Gail S. Young, a professor of mathematics education at Teachers College, Columbia University, compared the convocation to the Calculus for a New Century conference, held at the National Academy in 1987. "That conference did start work on modifications of the present calculus course, but does not seem to me to have had much effect," he said. "This convocation has been much more exciting, more realistic. It might have a real impact." And compared to a meeting of mathematics faculty of traditionally black institutions in the South that he attended in 1970, the convocation participants were much less isolated, he said. "Here people are much more informed, alert, and active. It's a real upward change for minorities in the mathematical community."

McDonald was encouraged that the convocation took place, "but I wonder how the goals will be interpreted and enacted by the various organizations," she said, referring to the Ten-Year Plan. But also, she said, "while we're waiting for this massive national movement to take place, we shouldn't forget that indviduals can make a difference right now." James A. Donaldson, professor of mathematics at Howard University, says that he was somewhat disappointed with the Ten-Year Plan recommendations, which he felt neglected such important issues as building confidence and self-esteem, curricular content, and the way that subordinated groups are sometimes unintentionally discouraged. "I felt that they could have gone much farther with recommendations for the Ten-Year Plan," he said. "Still, it was very useful to meet with so many seriously committed people."

The convocation brightened prospects for change, but also seemed to point up some obstacles. Lee Lorch, professor of mathematics at York University in Canada, criticized the speeches by Lauro Cavazos, U.S. Secretary of Education, and John B. Taylor of the President's Council of Economic Advisers, the highest-ranking government officials in attendance. "The government representatives had diplomatic words indicating the worthiness of the objective, but absolutely no suggestions that the government is going to put its money where its mouth is," said Lorch.

However, the convocation succeeded in gaining the attention of a wide range of groups. "This was an excellent effort to create a focal point in which individuals and agencies can look at some of the causes of the problems and commit themselves to solutions on a specific timetable," said Johnny L. Houston, professor of mathematics at Elizabeth City State University and president of the National Association of Mathematicians, an organization of black mathematicians. "The point is to make this a national priority. This group may have done that. The jury is still out, but the effort has begun."

Minority achievement in mathematics is often cast in terms of a problem needing a solution rather than a possibility for success. "Listening to the data, it's easy to get discouraged," said Shirley Malcom, head of the Directorate for Education and Human Resources Programs of the American Association for the Advancement of Science. "I'm not a masochist. I would not have stayed in the work if there were no possibilities. Don't despair. I'm here because of the urgency of the problem, but also because of the possibilities."

Allyn Jackson
Staff Writer

Forum

The Forum section publishes short articles on issues which are of interest to the mathematical community. Articles should be between 1000 and 2500 words long. Readers are invited to submit articles for possible inclusion in Forum to:

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

Small Research Grants

Jerome A. Goldstein
Tulane University

The issue of small research grants has been under discussion in the mathematical community in recent years. In particular, this has been a recent topic considered by the advisory committee of the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF), on which I have just completed a three year term.

The key background issue is that relatively few mathematicians have federal funds to support their research. The health of our entire mathematics profession depends on the health of our research enterprise, and it needs improved health. Here are some interesting figures. The number of mathematicians teaching students (full time) in four year colleges and universities is around 25,000. Of these around 10,000 are active in research and close to 2,000 have federal funds to support their research. Let us summarize this by saying that 7-10% of the mathematics professors are federally funded. (Here funding includes NSF, DOD, DOE, NIH, etc.) The corresponding percentages in chemistry and physics are estimated to be in the 40-50% and 50-60% ranges. So here is one criterion by which we, as a community, fare poorly.

Not surprisingly, most mathematicians would like to see more mathematicians involved in federally funded research. Indeed, this was one of the main priorities of the 1984 David Report, and it remains a principle priority of the forthcoming David II report, formally known as *Renewing U.S. Mathematics: A Plan for the 1990s*. (For the Executive Summary of David II, see the May/June issue of *Notices*, vol. 37, no. 5, pp. 542-546.)

One goal of the original David Report was to increase the number of funded researchers from 1800 to 2600, an increase of 800. (Think of a funded researcher as a (maybe co-) principal investigator on a grant providing summer salary support. Again, this 1800 includes those funded by NSF, DOD, etc.) By now the 1800 has increased to 1900, so David II recommends an additional 700.

Of course we have seen a big increase in postdoctoral fellowships, graduate student support, institute support, and conference support. But mathematicians tend to think of mathematics as an individual endeavor and the support of the research of individuals remains a high priority.

Available funds are limited, and if it is not possible to fund deserving scholars with "big" grants then the discussion of "smaller" grants inevitably follows.

If we can get the additional 700 grants recommended by David II plus 500 more grants, then we have 3100 funded researchers, a significant increase from 1900. (But our percentage moves up to 11-14%, still far below chemistry and physics. Incidentally this discussion illustrates why many thought the original David Report understated the problem.)

Several reasons have been offered both in support of and in opposition to small grants. Here is a sampling of each.

Arguments in support. It is the grant, not the size of it, that brings the recipient satisfaction, recognition, and inspiration. It applies pressure to the individual to do research and publish it. More successful grantees could serve as role models for attracting students into the profession. The Canadian system works well. A significantly higher percentage of deserving active researchers could be funded.

Arguments in opposition. A substantial grant brings a significant amount of leveraged, dedicated time. The scholar is forced to do research, there is no excuse for failing to make it one's top priority. A small grant is not nearly as effective in this respect. A large number of

small grants is a hard and unwieldy thing to administer. Reviewers already complain about being overworked. The paper work is enormous. Some believe there are not 3,000 mathematicians in America whose research is worthy of support by our tax dollars.

The Association for Women in Mathematics (AWM) has an NSF grant for (small) travel grants for female mathematicians. This is widely regarded as a very successful program.

I next wish to describe a particular model discussed at the recent DMS Advisory Committee meeting in April 1990. The reader should regard this model as a "trial balloon". The American Mathematical Society (AMS) will be mentioned, but the ideas discussed in the sequel are preliminary and not officially endorsed (either positively or negatively) by the AMS. So here, finally, is the idea.

"AMS Research Grants" are created, with 500 being given each year with an average funding level of $2500 per year. These might range from $1000 to $5000, depending on the nature of the proposal, but the canonical grant would be for $2500. This would be administered by the AMS through *some* mechanism, undoubtedly involving panel review. NSF and other federal agencies would fund it for the first five years. The AMS would try to build up an endowment to continue its role as a research funder. The federal support for this program would be temporary (under the possibly unrealistic assumption that the AMS can generate the requisite endowment). Maybe the federal funding agencies would like this idea so much (especially the temporary aspect of their funding) that they would find new funds for this program. (This too may be an unrealistic assumption).

The DMS Advisory Committee generally favored this idea.

It is a widely held view that the David Report was marvelous and effective. It dramatized our problems and it led to real progress in the funding of mathematics (more money, more postdocs, more graduate student support, etc.) But it understated the problem and some of its important recommendations have not yet been implemented. Much more needs to be done. It will be difficult to find the money to fund the additional 700 researchers recommended by the David II report. And even then, with 2600 funded, many talented and active research mathematicians will still be untouched by national funding.

Up to this point I have tried to avoid my biases and present a balanced picture of the small grant situation. Here, for the record, are my own views:

It is my personal feeling that if there exists a fixed amount of money to spend on research, the profession derives more benefit from a lot of small grants rather than from a modest number of substantial grants. (I leave aside the fact that the nature of our grants may well affect the size of the available pot).

A standard summer grant buys two things: the dedicated time and the good will of the investigator. By the time a senior mathematician (who is a committed researcher) is making a good salary, conscience and competitive nature will dictate that her/his summer time be spent on research, whether or not it is funded. Currently there is a salary cap of about $8,000 per month, which affects those with an academic year salary of over $72,000. Perhaps 20% of the DMS principal investigators fall into this category. It is not clear to me that an NSF grant is really buying the time of these researchers.

It bothers me that, in my own department, only a minority of the deserving (in my opinion) researchers have external research funding.

When the academic job market turned sour in the 1970s, many qualified researchers took jobs in schools without research traditions. We thus created a national resource ("good mathematics almost everywhere") which we can but have failed to exploit. These schools train many of our future research mathematicians. They would train more if the qualified professors who should inspire these students can remain active and enthusiastic over an extended period of time. Small grants would help these professors and their institutions. Since generally the better scholars are at the better institutions, and since the awarding of grants must be made on a comparative quality level, the only way to support effectively the researchers under discussion is to increase substantially the number of grantees.

The NSF funding of conferences touches a lot of graduate students and young researchers who do not have other research support. The enthusiasm that these youngsters (and oldsters too) express and their resulting renewed commitment to the study of mathematics persuades me that it is a marvelous idea to maximize the number of researchers touched by federal funds.

I would like to make one final personal observation. It has been a privilege and an extraordinary experience for me to have served on the DMS Advisory Committee. The staff at NSF is fantastic. They have patiently listened to all the complaints expressed by me and my colleagues. They have generously shared their thoughts with us, displaying total frankness and compassion. They are incredibly hard working and devoted to the welfare of the American mathematical community. Some may bitch and moan that we are not where we should be with respect to funding in mathematics, but we are in much better shape than we would be otherwise because of the heroic efforts of Judy Sunley, Bernie McDonald, Jack Ryff, Ralph Krause, Ann Boyle, Al Thaler, and all the others at DMS. Our community owes them our deepest expression of thanks (and our most serious urging to keep up the good work and to do even better in the future).

We must keep our talented research corps active and motivated with high morale. We must attract good students into mathematics, in greater numbers. These are the issues before us. It is really important that the community get involved. Discuss these matters with your colleagues. Write to Judy Sunley and others at the DMS of NSF; write to Bus Jaco and others at the AMS; write to the DMS Advisory Committee's new chair, Mary Wheeler, and its other members. Please involve yourself. The health of our whole mathematics community depends on the health of the research enterprise.

More on Researchers and Education

Hugo Rossi
University of Utah

I read with interest and enthusiasm the articles in the first FORUM (*Notices*, April 1990). The question, *What is the role of mathematical researchers in mathematical educational reform?* is now being asked at all major conferences and meetings, inspired, I suppose, by the insistence of the leadership of the National Science Foundation (NSF) some years ago that there just has to be some such role. Election to the Council last year drew me from the relative peace of science in Utah and dropped me in the AMS' Committee on Long Range Planning which is now asking me the same question. As I must now answer it, I choose to do so with a contribution to the FORUM.

There is a role for research in education reform. Drs. Herb Clemens and Harvey Keynes are right; but I disagree with them. Herb's plan for direct involvement of research mathematicians in grade school education is a credible and creditable one. Where this was done with imagination, ingenuity and patience (and Herb excels with all three) it has been exceedingly successful. And it is best to get to them in grade school before *their interest and excitement yields to other compelling influences.* However, I do not believe that the central issue is the preservation of the species. Harvey argues, and (as a Dean) I support him, that attitudes must change: *professional tolerance for colleagues who want to become involved in education should be encouraged at all levels.* But I find fault with what he says later: *It is frequently not the conception of the project, but the enormous organizational and administrative efforts, together with sensitivity to classroom cultures in the context of mathematics content, that makes for successful educational programs.* While I agree with him, I do not see this as the business of the research mathematician who might best be left out of those efforts.

What then is the central issue, and how can the research mathematician be useful in addressing it? Before giving you my response, let me confess that I have been unfair to the writers of April's FORUM articles. For the purpose of my own axe-grinding, I have attributed to them interpretations of their writing to which I know they do not ascribe. Dr. Clemens is not saying that cultivation of future mathematicians is the central issue of educational reform; he is saying that it is an issue, and the one to which research active mathematicians can address themselves without compromising that activity. Dr. Keynes is not saying that research mathematicians should applaud, support, and even become, those among us who are prone to meddle around in education as if we knew better. Through his own work, Dr. Keynes has amply demonstrated his very clear conception of the role of the researcher in educational reform, and he makes us understand that the projects to which he refers require the combined effort of educators and professionals at all levels, each playing their appropriate role. What then is that role of the researcher in education, and how is it to be implemented, and in what ways can the AMS be involved?

The central feature of research is that the worker must live, intellectually, in a highly ambiguous environment. Problems are not really well formulated, the data is either insufficient, buried in irrelevancies, or both, approaches are obscured, and outcomes, although guessed at, are highly uncertain. To put it bluntly, most of the time we feel stupid. The issue in education for the researcher is that the purpose of our educational system seems to be to drive out, at the earliest age possible, any ability to tolerate the feeling of stupidity. This is an observed phenomenon: men and women entering college do not display the same eager inquisitiveness, curiosity and tolerance of their own intellectual innocence which is displayed by boys and girls entering first grade. It is not my purpose to go into the causes of this although I believe that the intellectual standards of our culture play a significant role.

Why don't girls and minorities do as well in mathematics as white boys? First of all, although this is a popular question, the assumption underlying it is mistaken. The correct observation is that girls and minorities do as well as boys at the same educational level, but drop out of the math/science curriculum at markedly higher rates. Why? Because being unsure of yourself doesn't look good. The difference between underrepresented and overrepresented groups is that of acceptance; if you are a member of the majority, it is automatic; if not, it has to be achieved. These are obvious but not trivial statements. The discomfort of intellectual uncertainty is very difficult to tolerate, all the more if you are on the outside looking in. If you are accepted, it's not so bad to take risks; recovery (often by bluff) comes easy. If you are aspiring for acceptance, risks and displays of uncertainty and weakness are to be avoided, and attempts at bluff are disastrous.

What is the role of the researcher in education? To turn things around; insist that it's not only OK to live with uncertainties, but that it is essential to progress. Insist that having to work in ambiguous situations is not restricted to research mathematics, or the academic environment, but is a reality throughout the professions and today's workplace wherever it is. Instruct that there is more value in the thrill of the hunt than the size of the trophy; help create endless illustrations of this at all educational levels, and above all, crusade to get this program adopted. (We have had several years now of pilot and model educational projects, some of which are exceptional. There is less need today for pilots than there is for stewards).

How is the role played out? Clemens and Keynes have two excellent and important ideas: 1) stop being so smart, go out and be stupid for the kids, show them what it is about scientific research that attracts you; 2) struggle to change our academic culture so that not only do we notice that there are students around, but we know how to shepherd them through intellectual challenges. These ideas are important, not only because they address the problems directly, but because they address the culture; they make a statement.

As I have unfairly paraphrased the content of other articles, I have unfairly represented my own thesis. I can do a better job of expressing my ideas only by citing examples which illustrate them in operation. (First suggestion: let that last sentence be our guide in teaching).

Phil Wagreich, University of Illinois at Chicago, and coworkers have developed a sequence of "experiments" (basically elementary qualitative physics) for primary school children. They have worked directly with the teachers, using illustrative experiments at their level as well, so that the teachers themselves get to experience the thrill of uncertainty before introducing it into the grade school environment. This program has had remarkable success with the disadvantaged student in the Chicago area. Here, in the state of Utah, some of us are hoping to move part of the grade school curriculum away from workbooks by similar techniques. We have begun to train "teacher-leaders" for the school who can instruct their colleagues in experimentation and provide tools for it. I am teaching calculus to a small group as part of this program. No, I'm *not* teaching calculus; I am showing them how to analyze data graphically, that dynamical processes are understood by formulating the rules of change, how to test hypotheses by means of specific data and spreadsheet manipulations. Last week we worked on inhibited growth, and by studying the US census from 1790 deduced that the US population looks like it will stabilize toward the end of the next century at around 299 million.

The NSF programs, *Young Scholars* and *Research Experiences for Undergraduates*, are superb programs from this point of view. Although they are motivated by preservation of the species and directed toward the most promising young scholars, they have profound effects in other ways.

First of all, we the researchers are introduced to the idea that there is something to the way we do our work which must be, and *can be*, communicated at all educational levels. Secondly, these students become conduits of scientific method to their colleagues. In effect then, although it doesn't say so in the NSF announcements, these programs are direct attacks on the national culture.

What is the role of the AMS in mathematics education? If I am right, that the role of the researcher is to insure by illustration that the technique and ideas of the process infect the entire educational enterprise, then the role of the AMS is clear: it must explain to the schools, the public, the government and, above all, *its own members* what mathematics research is doing, how and why. It must do so in its own meetings, its publications, and through its interaction with other societies. We need expository journals, conferences and panel discussions. Above all, our research leaders need to feel in their joints and eyesockets the absolute necessity of explaining to that world out there, the one we live in, what they are doing. The age of the mathematician who declares, "I do what I do because I do it" is over.

Do I have a good idea? Will it work? Do they do it in Japan and Korea? I don't know the answers to the first two questions, but the answer to the last is: *No.* What they do in Japan and Korea is endless workbooks, drill and exercise. They do require everybody to take a lot more mathematics, but their technique is about the same as ours; their classes are as full, and their texts as dull. Well then, why should we do something different? Because what we (and they) are doing isn't working here. The Japanese culture (as well as the Jewish, Chinese and other cultures which produce disproportionately large percentages of research scientists) has a deep respect for inquisitiveness, contemplation and intellectual probing; it is built into their religion, their society and their education. We have no such asset, and we're not going to get it by paying for it or proclaiming an education Presidency. All we can do is give the kids a viable alternative to the press of instant gratification prevalent in our culture, and let them run with it.

Inside the AMS

Committee for Academic Review

J. K. Goldhaber, Chair

The Committee's charge was to consider two topics: guidelines for the use of mathematics visiting committees and the question of accreditation of mathematics departments by AMS. The Committee's immediate, unanimous, and emphatic response to the question of accreditation is that the AMS should not be involved. Our general response to the first topic, however, is that the AMS should serve, but not dictate.

Developing guidelines for mathematics visiting committees involves two tasks: compiling a list of external visitors and suggesting topics for consideration by the reviewing committees. We feel that the AMS should not appoint external visiting committees. We do recommend that, in response to many requests, the AMS should maintain and regularly make available a list of individuals who are willing to serve as visitors, cross-referenced by geographical area and area of interest. One possible procedure for developing such a list would be to invite those who are interested to submit their names.

Topics for possible consideration by review teams will be drawn up by this committee and will include specific questions that address the quality of the program and the consonance of a department's stated mission with the department's actual performance. Some obvious items for consideration are appropriateness and quality of undergraduate and graduate curricula; the quality of the department's Ph.D. output; the average length of time to degrees; the structures for determination and reward of faculty merit; etc. We may also identify specific input and output measures that can be used to address these questions. From the list of possible areas of focus, the department to be reviewed could ask the external review team to pay particular attention to a subset of these items.

We are looking at the activities of professional societies of other academic disciplines to see what programs they have in place concerning external review committees.

The Mathematical Association of America's (MAA) Committee on Consultants has also tackled this topic and has in fact published a "Program of Consultants: 1990 Information Booklet." There is a general feeling that, to avoid duplication of time and effort, this committee should work together with the MAA committee to provide this service and that both committees should be coalesced into a single MAA/AMS committee.

Comments and suggestions on procedures for developing a list, on appropriate topics for consideration in a review, and on the joining of the two committees are solicited and would be most welcome. Please send your comments to any of the committee members listed below.

F. W. Gehring, University of Michigan
F. L. Gilfeather, University of New Mexico
A. M. Gleason, Harvard University
J. K. Goldhaber, Chair
D. A. Sanchez, Mathematical and Physical Sciences Directorate, National Science Foundation

Committee on Human Rights of Mathematicians

Alice T. Schafer, Chair

In the past two plus years the Committee has considered seven cases of human rights violations of mathematicians or teachers of mathematics from six different countries: Canada, Chile, Malaysia, Palestine (West Bank), Somalia and Tunisia. In addition, at the AMS Centennial Meeting, August 1988, and at the Joint Mathematics Meetings in Phoenix, January 1989, the Committee circulated petitions on behalf of Russian mathematicians who wished to emigrate but had not been allowed to do so: nine at the first meeting and 14 at the second. At the Phoenix meetings petitions were circulated on behalf of two individual mathematicians.

The situation has improved so much in Russia that of the 14 individuals named in the petition of 1989, 12

have been allowed to emigrate. One individual on whose behalf a petition circulated has been released from prison and allowed to return to his position. The person named in the other petition has been released from prison and has a job offer at a university in the United States but, because his passport has not been returned to him, he has been unable to leave his country to accept the position. There is hope that his passport will soon be returned to him.

A current case of concern to the Committee is that of a mathematician who was imprisoned because of his criticism of his country's government. He was tortured while in prison, his passport was taken from him, his university salary was stopped, which left his wife and children without an income, and he was never tried. He was finally released from prison but not allowed to return to his position, nor was his salary reinstated. The government made two offers which he refused: one a position at a less prestigious institution at some distance from his home; the other permission to accept a temporary position in another country without promise that he can return to his previous position on his return to the country. Recently he wrote an article for a newspaper in which he was critical of the government but not recommending any violence. Again he was imprisoned. He has now been tried and has just received a two year prison sentence, which he is appealing. So, as far as the American Embassy in his country knows, he is not being tortured.

The case above, described in some detail, contains many of the features found in others cases: individual, not urging any violence, imprisoned, often without any charge, kept in prison and released only when the legal time for holding a person prisoner without a charge expires (true in the above case) - not all countries have such a law - tortured while in prison, passport withdrawn, family left with no income. In all cases the Committee has sent letters and sometimes cablegrams to the appropriate government authorities asking for information and urging leniency. In the past two years, two members of the Committee have personally investigated cases while they were visiting a country where the Committee was working on particular cases.

The Committee investigated the case of the Chilean mathematics student Christian Meneses Torres who was arrested on April 10, 1985 by the Chilean police. [See the Report by the Chair of this Committee, C. Herbert Clemens, in *Notices*, August 1987.] According to the U.S. Department of State, which obtained information from our Embassy in Santiago, he was arrested for violating the arms control law, released on bond July 9, 1987, and "his case may be resolved in the near future".

The following groups have been very helpful to the Committee in its work by providing information in some individual cases: Committee of Concerned Scientists (New York), the Human Rights Committees of the American Association for the Advancement of Science (AAAS) and the National Academy of Sciences, and the Chicago Action for Soviet Jewry.

Sponsored Membership Program

Last year, the American Mathematical Society initiated a program of sponsored membership. Under this program, individuals and organizations may "sponsor" eligible mathematicians for membership in the Society by paying their membership dues. The program enables individuals who may not otherwise be able to pay the dues to be members of the Society. Therefore, eligibility for sponsorship is limited to individuals residing in countries with currency restrictions or in developing countries. The individual being sponsored need not be a current member of the Society. The dues rate to be paid for the sponsored member will be one-half the higher ordinary dues rate. For 1990 the sponsored member dues rate will be $46; for 1991 it will be $50.

If you know an individual whose membership you would like to sponsor or if you would like to learn more about the program, please contact Carol-Ann Blackwood, Membership Manager, American Mathematical Society, P.O. Box 6248, Providence, RI 02940 or via e-mail to AMSMEM@MATH.AMS.COM.

Washington Outlook

This month's column is written by Kathleen Holmay, who is the Public Information Director of the Joint Policy Board for Mathematics.

During the last weekend in April, I took a two-day hiking trip outside the Washington area and literally brought the message of Mathematics Awareness Week, Communicating Mathematics, with me. During the first day on the Appalachian trail, I wore a T-shirt celebrating MATHCONN '90, an annual event organized by Dr. Regina Brunner at Cedar Crest College that is designed to encourage women to pursue mathematics. During the second day, I elicited a couple of curious looks from other tourists in rural Pennsylvania because I was sporting a T-shirt with an eerie sleuth on the front which said "Mathematics Murder Mystery - Worcester Polytechnic Institute" on the back.

These were just two of the "gifts" I received from Mathematics Awareness Week 1990. Others were largely reports on a host of activities which were carried out in classrooms and other locations across the country - from a juggling explanation demonstration at Derby High School in Wichita to a poster contest for Washington, DC, area high school students sponsored by George Washington University. Clearly, a great many activities to "Communicate Mathematics" occurred during April.

By mid-May, the staff of the Joint Policy Board for Mathematics (JPBM) Office of Governmental and Public Affairs had dealt with over 300 requests for posters, postcards, and general advice. Moreover, Mathematics Awareness Week was the subject of an editorial in *The Washington Post*. While the writer saw the celebration as a "publicity gimmick", the editorial did recognize the importance of communicating mathematics and did acknowledge the "problems faced by math educators."

What may be even more noteworthy is that such activities in mathematics are by no means confined to one month any longer. In March, I had the pleasure of attending a symposium, "Modern Perspectives of Mathematics: Mathematics as a Consumer Good", sponsored by the Mathematical Sciences Institute (MSI) at Cornell. It was clear to all who attended this meeting that the bridge spanning research interests and teaching needs was not only in place but being crossed repeatedly in a manner that allowed mathematicians on both sides to appreciate and understand each other.

Calvin C. Moore, associate vice president for academic affairs at the University of California and a member of the Mathematical Sciences Educational Board, talked about the general lack of appreciation of the role mathematics plays in all of science and technology. He warned the attendees of the danger of continued acceptance of the lack of interest in the field by most minority students. Moore informed his audience that white males comprise only 15 percent of this year's freshman class at Berkeley. He reiterated this figure to a stunned audience adding, "I said 15 percent, not 50."

Opening a compelling talk about "Communicating Mathematics," Ivars Peterson of *Science News* said, "To most outsiders, modern mathematics represents unknown territory; its borders protected by dense thickets of technical terms; its landscapes strewn with indecipherable equations and impenetrable concepts. Few realize that the world of modern mathematics is rich with vivid images and provocative ideas."

Peterson asked the audience: Where can an outsider go (to learn about mathematics)? He said that, "People seem genuinely interested in what goes on in mathematics, if the material is presented in a way that is meaningful to them," but acknowledged that there are few such avenues for the layperson today.

"My experience as a journalist reporting on mathematical research," he said, "has considerably broadened my view of mathematics. What I have come to appreciate is how much the understanding of mathematics requires hard, concentrated work. It combines the learning of a new language and the rigor of logical thinking, with little room for error."

Two reporters who were fairly new to mathematics attended this symposium through a special arrangement the JPBM was pleased to make with MSI. Clearly, their work was cut out for them, and I had the pleasure

of watching these two adept communicators work. I observed as they absorbed and deciphered the messages of the meeting and then asked questions which allowed them to ferret out a "story" from it for a lay reader. Several results were: a front-page story in the *Oakland Tribune*, calls to my office for more information on the problems of human resources in mathematics, requests regarding the "pipeline", etc.

Simultaneously, the JPBM Public Information Office makes many other media contacts on a daily and weekly basis. NBC-TV, for example, has been talking with us over the last two months regarding a program they are doing on the differences in achievement between girls and boys, focusing on the U.S.A. Mathematical Olympiad. This is a topic that immediately makes a television producer think of mathematics. For us, NBC's interest is an opportunity as well as a challenge. The opportunity, of course, is to get nationwide coverage for mathematics - if we survive the rigorous television editing process. The challenge is to portray mathematics as a field in which girls can and do excel - notwithstanding the statistical evidence that few of them do well in competitions and that too few choose the discipline. We have collected and forwarded a number of items to NBC - information on the performance of girls and boys in mathematics competitions, information about women who have succeeded in mathematics, etc. Yet, we can only hope to shape the story, not write it.

There is ample evidence that mathematics has become a viable subject of potential interest to the public. The challenge for us is to determine where to go from here. We need to carefully focus our efforts so that we maximize our resources.

What needs to be done in the short term is apparent. First, there is an opportunity to introduce Chicago area science writers to the speakers and their topics, especially new ones like Karmarkar's interior-point methods for linear programming, during the Society for Industrial and Applied Mathematics' summer meeting in July. Then, the Mathematical Association of America's (MAA) 75th Anniversary is the focus of the 1990 summer Joint Mathematics Meetings in Columbus. Juggling and mathematical sculpture are two obvious stories which may interest general reporters. Yet, they represent only a small fraction of what happens at such a meeting.

In the longer term, three priorities stand out. First, the JPBM Public Information Office continues to explore ways to generate and place a regular column on mathematics in newspapers across the country.

The second is that 1992 is both International Space Year and the anniversary of Columbus' first voyage to this continent. Both of these events are potential windfalls for communicating mathematics. We would like to assemble and distribute to reporters an information kit with many short summaries describing such topics as how Columbus navigated across the Atlantic and how mathematics is used in studying global climate change.

The third longer-term priority dovetails with the second. How can we establish an active network of mathematical expositors at several key institutions across the country who would be willing and able, through special arrangements with their departments, to work with us to produce explanatory materials for the media? The objects are to multiply the efforts of the JPBM Public Information Office without adding more staff in Washington and to display the expository talents of mathematicians who are located throughout the nation.

If you would like to volunteer for this exciting project, please contact me: Kathleen Holmay, JPBM Public Information Director, 1529 Eighteenth Street, Washington, DC 20036.

ALGEBRAIC TOPOLOGY

Mark Mahowald and Stewart Priddy
(Contemporary Mathematics, Volume 96)

This book will provide readers with an overview of some of the major developments in current research in algebraic topology. Representing some of the leading researchers in the field, the book contains the proceedings of the International Conference on Algebraic Topology, held at Northwestern University in March, 1988. Several of the lectures at the conference were expository and will therefore appeal to topologists in a broad range of areas.

The primary emphasis of the book is on homotopy theory and its applications. The topics covered include elliptic cohomology, stable and unstable homotopy theory, classifying spaces, and equivariant homotopy and cohomology. Geometric topics—such as knot theory, divisors and configurations on surfaces, foliations, and Siegel spaces—are also discussed. Researchers wishing to follow current trends in algebraic topology will find this book a valuable resource.

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News and Announcements

Lamberto Cesari
1910-1990

Lamberto Cesari, professor emeritus of mathematics at the University of Michigan, died March 12, 1990 at the age of 79. Cesari was known worldwide for his research in a variety of areas, including differential equations and optimal control.

Cesari was born on September 23, 1910 in Bologna, Italy. He studied at the prestigious Scuola Normale Superiore in Pisa and received his Ph.D. in 1933 from the University of Pisa. His first position was at the Institute for Numerical Analysis of the National Research Council in Rome. In 1935, he became an instructor at the University of Rome and returned in 1938 to the University of Pisa as an assistant professor. He moved to the University of Bologna in 1942 and became a full professor there in 1947.

Two years later, Cesari came to the U.S. and spent a year at the Institute for Advanced Study in Princeton. Over the next four years, he held visiting positions at the University of California at Berkeley, the University of Wisconsin, and Purdue University. He stayed at Purdue until 1960, when he moved to the University of Michigan. At Michigan, he was named the first Raymond L. Wilder Distinguished Professor of Mathematics and also held the position of Henry Russel Lecturer, the highest title bestowed on senior faculty at the University. He retired in 1980.

Cesari was awarded the degree *laurea honoris causa* by the Univeristy of Perugia in 1978 and was elected to the Accademia dei Lincei in 1982. He was a corresponding member of the Academies of Science of Bologna, Modena, and Milan. A member of the AMS, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics, he also belonged to several Italian mathematical societies.

During his long career, Cesari served on several editorial boards and wrote four books and over 220 papers. He did some early work in the theory of surface area, on multidimensional functions of bounded variation and Serrin-type functionals. One of Cesari's abiding interests was the study of problems in the calculus of variations, and he also did a great deal of work in optimal control. Particularly noted for his study of the existence theorems for optimal solutions for both single- and multi-dimensional systems, he also contributed to the theory of necessary conditions and the analysis of Pareto problems. A significant portion of his contributions to this area may be found in his last book, *Optimization: Theory and applications*, published in 1983.

In the last twenty years, much of his attention was devoted to the study of questions arising in nonlinear analysis and its applications to differential equations. He continued his work, begun in the 1950s, on the Alternative Method, especially as applied to problems with large nonlinearities. He also investigated the existence of solutions to certain quasi-linear hyperbolic systems. In recent years, he continued his study of existence theorems, analyzing various problems, including those which arise in the theory of plasticity and whose optimal trajectories may contain jump discontinuities. During the last few years of his life, Cesari worked on the theory of functions of bounded variation, a field that he himself had pioneered, and its applications to the theory of hyperbolic systems of conservation laws.

Dmitriĭ Konstantinovich Faddeev
1906-1989

Dmitriĭ Konstantinovich Faddeev, an outstanding Soviet mathematician and President of the Leningrad Mathematical Society, died on October 20, 1989 at the age of 83.

Faddeev's mathematical legacy is unusually diverse. His primary area was algebra, but he also made significant contributions to other areas, such as number theory, function theory, geometry, and probability theory. Faddeev had a profound influence on the formation and development of numerical methods in mathematics, and the book, *Numerical methods in linear algebra*, which he wrote with V. N. Faddeeva, has been a reference source for several generations of specialists. A keeper of the tradition of the Petersburg school of mathematics, Faddeev was a laureate of the State Prize of the U.S.S.R., and a corresponding member of the Soviet Academy of Sciences.

In addition to a publication list of more than 160 titles, Faddeev's career was marked by his interest in education. He was known for his many students, his contributions to the structuring of contemporary mathematical education, his creation of internationally-known scientific schools, and his outstanding textbooks.

Edgar R. Lorch 1907–1990

Edgar Raymond Lorch, a major figure in the algebraization of analysis and its recasting in geometrical language, died on March 5, 1990. He had been on the faculty of Columbia University for many years.

Lorch was born in Nyon, Switzerland on July 22, 1907, and came to the U.S. in 1917. He earned his A.B. in 1928 from Columbia College, and his Ph.D. in 1933 from Columbia University, under the direction of J. F. Ritt. In that same year, he was awarded a National Research Council Fellowship to work with M. H. Stone. The following year, he declined the position of assistant to John von Neumann at the Institute for Advanced Study to accept the Cutting Traveling Fellowship in Hungary to study in Szeged with Frigyes Riesz. Lorch in turn provided guidance to a succession of budding mathematicians during his long career at Columbia.

He began his long teaching career at Columbia University in 1935, serving as chair of the department from 1968 to 1972. In 1977, he retired as Adrain Professor Emeritus, and had also held the position of Chairman of the University Seminar on Computers, Man, and Society since 1982. He was a research mathematician in 1944 at the National Defense Research Council and served in 1948 as Scientific Advisor to the Chief of Staff of the U.S. Army at the Pentagon. In addition, he held professorships and lectured throughout the U.S. and Canada.

Lorch's most enduring mathematical contribution was perhaps in the theory of Banach spaces and spectral theory of operators in Hilbert space, which were quite new at the time he was working on them. In these theories, which are now standard equipment in pure and applied mathematics, problems of classical analysis can be reformulated in ways that permit the use of algebraic computation and geometric intuition in their solution. In addition to over 100 articles in a wide range of mathematical areas, Lorch's publications include *Spectral Theory* (the classic reference in the field), *Analisis Funcional*, and *Precalculus*.

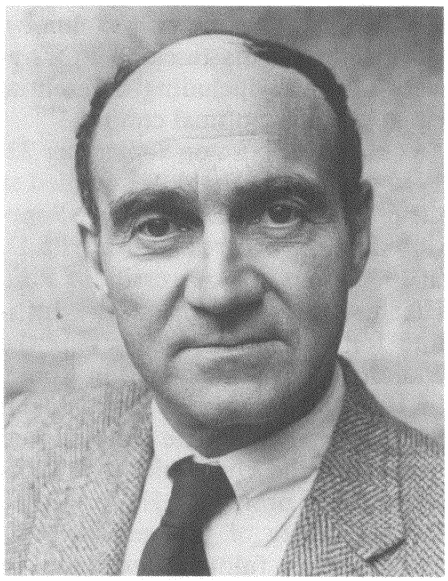
Throughout his career, Lorch was especially interested in developing international ties among mathematicians. Able to lecture fluently in five languages, he pursued many international activities, such as serving as a Senior Fulbright Lecturer in Italy, France, and Colombia; holding a corresponding membership in the Accademia dei Lincei of Italy; contributing to the founding of the Mathematics Department of the Middle East Technical University in Ankara, Turkey; and establishing a course in functional analysis at the Universidad de los Andes in Colombia. In addition, he was also a frequent guest of the Zürcher Gespräche in Zurich and Dusseldorf.

He was also an active member of the AMS, serving on various committees and as a teller in AMS elections (1937-1943), Member-at-Large of the Council (1952-1954), and Associate Editor of the *Bulletin* (1945-1950). He delivered an AMS Invited Address on the structure of normed abelian rings in 1944. He was also a member of the Mathematical Association of America and several foreign mathematical societies.

Together with his wife, Lorch founded in 1980 the Center for International Scholarly Exchange at Barnard College, in which he remained active until his death. In 1989, he was honored by the University of Szeged in Hungary for his work with Riesz. Lorch also had a deep interest in international education, as well as in environmental concerns. In addition, he was an accomplished pianist, organist, and composer.

de Branges Receives Ostrowski Prize

Louis de Branges of Purdue University has received the first Ostrowski Prize for developing powerful Hilbert space methods which led him to a surprising proof of the Bieberbach Conjecture on power series for conformal mappings.



Louis de Branges

de Branges was born in Paris in 1932, but he grew up in the U.S. After receiving his Ph.D. in 1957 from Cornell University, he began investigating the question of whether every bounded linear operator on Hilbert space has a non-trivial invariant subspace, and also worked on the Riemann hypothesis. However, his greatest accomplishment was the 1984 proof of the Bieberbach Conjecture, which surprised a mathematical world accustomed to small steps forward. In addition to that proof, he obtained certain more general results concerning conformal maps. His Hilbert space theory has contributed substantially to the un-

derstanding of these and other problems.

The Ostrowski Prize of 50,000 Swiss francs was bestowed on de Branges on May 4, 1990 at the Mathematical Institute of the University of Basel. Jacob Korevaar of the University of Amsterdam, who was a member of the selection jury, presented the prize. The jury was headed by Norbert A'Campo of the University of Basel.

Alexander M. Ostrowski (1893-1986), who was a professor of mathematics at the University of Basel, established a Foundation for the Awarding of an International Prize for Higher Mathematics. The Ostrowski Prize is to be conferred every two years to a scientist or group of scientists who have achieved outstanding mathematical accomplishments, independently of politics, race, religion, domicile, nationality, or age. The jury consists of representatives of the Universities or Academies of Basel, Jerusalem, Waterloo (Canada), Copenhagen, and Amsterdam. The Foundation began its activity after the deaths of Ostrowski and his wife.

Atiyah To Head Trinity College and New Institute

Sir Michael Atiyah has been appointed Master of Trinity College of the University of Cambridge. In this position, considered to be one of the top two academic positions in the United Kingdom, he will be the administrative head of the largest and wealthiest College in Cambridge. He was formerly at Oxford University.

Sir Michael will also become the first director of the Isaac Newton Institute for Mathematical Sciences, which is being established at Cambridge. This research institute, which will be similar to the Mathematical Sciences Research Institute in Berkeley, will begin operation in July 1992.

In addition, Sir Michael will serve, beginning in November 1990, as the next President of the Royal Society. He will also be the AMS Gibbs Lecturer at the Joint Mathematics Meetings in San Francisco in January 1991.

Conference Board of the Mathematical Sciences

On the occasion of the thirtieth anniversary of its founding, the Conference Board of the Mathematical Sciences (CBMS) honored G. Baley Price, Professor Emeritus of mathematics at the University of Kansas, at a reception and dinner. The celebration was held Friday, May 4, 1990, in the new offices of CBMS. Dr. Price was CBMS' first Acting Chairman.

The reception was attended by the presidents and/or representatives of the fifteen CBMS member societies, executive directors of the Mathematical Association of America, the Joint Policy Board for Mathematics, the Mathematical Sciences Education Board and the National Academy of Sciences project MS2000, former CBMS administrative officers, and several of the NSF's Division of Mathematical Sciences officers.

An inscribed plaque was presented to Dr. Price in grateful recognition for his vision in helping foresee the importance to the mathematical community of strong Washington representation; for leadership in founding CBMS and leading it to formal incorporation on February 29, 1960; for energy in serving as the first Chairman of CBMS during 1958-59 and then as its first Executive Secretary in 1960-61; and for contributions to the mathematical community sustained over a period of six decades.

IEEE Honors Four Mathematicians

In a ceremony in San Francisco on February 28, 1990, the Institute for Electrical and Electronic Engineers Computer Society (IEEE-CS) presented to the Office of Naval Research (ONR) the Computer Pioneer Award for significant contributions to the early concepts and developments in the electronic computer field. This is the first time the IEEE-CS has recognized an organization for its research achievements.

At the same ceremony, IEEE-CS also honored four mathematicians who were considered the most outstanding computer pioneers at ONR. They were: MINA REES, who was the first head of the mathematics branch at ONR in 1946; the late JOACHIM WEYL, who came to ONR in 1947; MARSHALL C. YOVITS, who was head of the Information Systems Branch at ONR in 1956; and the late GORDON GOLDSTEIN, who came to ONR in 1956 and worked closely with Yovits.

Mathematical Society of Japan Prizes

The Mathematical Society of Japan has announced a number of prizes awarded to Japanese mathematicians. The 1990 Spring Prize of the Mathematical Society of Japan went to HIROSHI MATANO of the University of Tokyo for his outstanding contribution to the study of infinite dimensional dynamics and nonlinear partial differential equations. AKITO FUTAKI of the Tokyo Institute of Technology received the 1990 Geometry Prize, in recognition of the Futaki invariant he introduced in connection with the existence of the Kähler-Einstein metric on a complex manifold. The 1990 Japan Academy Prize was awarded to SHIGERU IITAKA of Gakushuin University, SHIGEFUMI MORI of Kyoto University, and YUJIRO KAWAMATA of the University of Tokyo for their outstanding contribution to the theory of classification of algebraic varieties.

Elections to American Academy of Arts and Sciences

The American Academy of Arts and Sciences (AAAS) was founded in 1780 by John Adams and other leaders of the American Revolution and is an international honorary society. As a leading force in American intellectual life for more than two centuries, the AAAS has a current

membership of over 3000 scientists, artists, business and public figures, including 148 Nobel Laureates and 58 Pulitzer Prize Winners. The purpose of the Academy, as set forth in its original 18th-century charter, is to "cultivate every art and science which may tend to advance the interest, honor, dignity, and happiness of a free, independent, and virtuous people."

Among the 96 individuals recently honored by election to the AAAS were five mathematicians: RUTH M. DAVIS of The Pymatuning Group, Arlington, VA, SOLOMON FEFERMAN of Stanford University, ROBERT P. LANGLANDS of the Institute for Advanced Study in Princeton, DAVID SLEPIAN of AT&T Bell Laboratories, and CLIFFORD H. TAUBES of Harvard University. In addition, H.S.M. COXETER of the University of Toronto and MARK VISHIK of the University of Moscow, were elected as Foreign Honorary Members.

Gordon Bell Awards Announced

Two computer models for problems connected to oil reservoirs received Gordon Bell Prizes in an annual competition given by Gordon Bell, vice president of Ardent Computer. Bell plans to give two prizes of $1,000 each for ten years, in order to stimulate advances in practical applications of parallel computing.

The prize in the raw performance category went to a team of researchers from Mobil Research and Development and from Thinking Machines Corporation. The team used a Connection Machine 2 with 65,536 processors to produce a finite-difference seismic model that achieved the outstanding performance rate of 5.6 gigaflops. The program ran six times faster than last year's winning program.

The price/performance award went to Philip Emeagwali of the University of Michigan. His oil reservoir simulation model, also implemented on a Connection Machine 2, achieved 365 megaflops per million dollars, a sevenfold improvement over last year's winning entry.

The deadline for next year's competition is **December 31, 1990**. Entries should be sent to Gordon Bell Prize, c/o IEEE Software, P.O. Box 3014, Los Alamitos, CA 90720-1264. The competition rules were published in the May 1990 issue of *IEEE Software*, which administers the competition.

Winners of the U.S. Math Olympiad

Eight mathematically talented students have won Olympiad Medals in the 19th annual USA Mathematical Olympiad (USAMO). The winners were honored on June 6, 1990 at an awards ceremony and dinner, held at the National Academy of Sciences and the State Department in Washington, DC. The three-stage competition involved nearly 400,000 students nationwide.

The eight USAMO winners are: KIRAN S. KEDLAYA, Georgetown Day High School, Washington, DC; JEFFREY M. VANDERKAM, North Carolina School of Science and Mathematics, Durham, NC; A. HUGH R. THOMAS, Kelvin High School, Winnepeg, Manitoba, Canada; JÁNOS CSIRIK, Lester B. Pearson College, Victoria, British Columbia, Canada; DANIEL R. L. BROWN, Earl Haig Secondary School, North York, Ontario, Canada; JOEL E. ROSENBERG, William H. Hall High School, West Hartford, CT; ROYCE Y. PENG, Roling Hills High School, Roling Hills Estates, CA; JONATHAN T. HIGA, Iolani School, Honolulu, HI.

One hundred forty-one selected students took the rigorous examination designed to test problem solving ingenuity as well as knowledge of mathematics. The USAMO competitors were the top performers in two earlier competitions, the American High School Mathematics Examination and the American Invitational Mathematics Examination, held in schools throughout the U.S. and Canada in March.

Following the awards ceremony, eligible winners and sixteen other students who did well on the USAMO participated in an intensive, four-week training session at the U.S. military academy at West Point. The purpose of the training session is to prepare a U.S. team of six students for the 1990 International Mathematical Olympiad (IMO), to be held in Beijing, China, July 8–19, 1990. The training session also prepares students for IMOs in subsequent years.

Romania initiated the IMO in 1959, and the U.S. has participated in the contest since 1974. Typically, 30–35 nations send teams to the competition. The U.S. team has usually placed among the top three nations in this prestigious competition, and in 1977, 1981, and 1986, the U.S. earned first place. Last year, China received the top honors, while the U.S. placed fifth.

Call for Nominations for Waterman Award

The National Science Foundation (NSF) is seeking nominations for the 16th annual Alan T. Waterman Award. This prestigious award is intended to recognize an outstanding young researcher in any field of science, mathematics, or engineering, and to encourage further high-quality research.

The award consists of a medal and up to $500,000 for up to three years of research or advanced study. The award was established by Congress in 1975 to mark the 25th anniversary of the NSF and to honor Alan T. Waterman, the first director of the Foundation.

Candidates must be U.S. citizens or permanent residents and must be 35 years old or younger, or not more than five years beyond the receipt of the Ph.D. degree by December 31, 1990. Candidates should have sufficient personal accomplishments, outstanding capability, and

exceptional promise for significant future achievement. Previous Waterman awardees in the mathematical sciences include Charles Fefferman, William P. Thurston, and Edward Witten, all of Princeton University, and Harvey Friedman of Ohio State University.

Nominations for the award may be submitted by individuals, professional societies, industrial companies, or other appropriate organizations within the scientific and educational communities. Nominations for the 1991 award must be received by **December 31, 1990**. Additional information and a copy of the nomination form may be obtained by contacting Susan E. Fannoney, Executive Secretary for the Alan T. Waterman Award Committee, 202-357-7512.

Reorganization of Education at NSF

In a reorganizaton of the Science and Engineering Education (SEE) directorate, the National Science Foundation (NSF) has relieved Bassam Z. Shakhashiri of his duties as Assistant Director for SEE. In that position, Shakhashiri was near the top of the NSF hierarchy and oversaw educational programs at all levels, including graduate fellowship programs and the calculus curriculum development program. Taking Shakhashiri's place as head of the reorganized directorate is Luther S. Williams, Senior Science Adviser to NSF Director Erich Bloch.

The removal of Shakhashiri follows a time of tension between him and Bloch, during which Shakhashiri took a high-profile position with Congress and the press in demanding large increases for NSF's educational activities. In asserting its own priorities within the Administration's request for the NSF budget, Congress has in recent years granted larger increases to SEE than had been requested, while paring away at the request for research activities. Part of the reason for the large increases for SEE is that its budget was effectively zeroed by the Reagan Administration, and it has taken a number of years of steady increases to put SEE back on its feet. Still, Shakhashiri was advocating tripling the SEE budget to $600 million by 1993, while Bloch's goal for the Foundation overall has been to double its budget. Both requests met with sympathy in Congress, but the SEE budget has increased more rapidly than that of the rest of the NSF.

Over the past few months, plans for a reorganization of SEE were circulated within the Foundation. The draft plans, formulated by a committee chaired by Williams and consisting for the most part of the Assistant Directors of the NSF, focused mainly on ways of shifting more of NSF's educational activities to its research divisions. Some of the ideas the committee considered would have produced substantial changes in NSF's educational activities.

In the end, the reorganization mainly consisted of a name change from SEE to Education and Human Resources (EHR) and of moving programs for minorities, women, and the disabled to EHR from the directorate for Scientific, Technological, and International Affairs. Still, it is unclear whether other changes will be forthcoming before Bloch leaves the NSF when his term ends in August of this year. His successor had not been named at the time of this writing.

Shakhashiri has been on leave for the last six years from the University of Wisconsin, where he is a chemistry professor. An NSF staff member said that Shakhashiri was asked by the university to make a final decision this year about whether or not he was returning. Shakhashiri's plans at the time of this writing were not known, but an NSF news release said that he will join the NSF Director's office.

Williams, a biologist, held professorships at the Massachusetts Institute of Technology and Purdue University (where he was Director of the Minority Center for Graduate Education) before becoming Dean of the Graduate School at Washington University in St. Louis. In addition, he was Vice-President for Academic Affairs at the University of Colorado, President of Atlanta University, and Deputy Director for the National Institute of General Medical Sciences. He has also served on a number of government science policy committees and currently chairs the White House Biotechnology Science Coordinating Committee. He came to the NSF in 1989.

Litigation Brought Against AMS Over Pricing Survey

The AMS is the target of litigation filed in the Federal Republic of Germany as a result of an AMS survey of prices of mathematics journals, published in the November 1989 issue of *Notices*.

The litigation, filed by Gordon & Breach (G&B) Science Publishers, Inc., claims the survey is "unfair competition" (comparative advertising), because G&B journals were found to be among the most expensive in the survey, while certain AMS journals were ranked in the bottom third. G&B attributes the price disparity to alleged "flaws" in the methodology of the survey.

The case follows close on the heels of similar litigation filed by G&B in the same German court against the American Physical Society (APS), the American Institute of Physics, and Henry Barschall, a retired physics professor at the University of Wisconsin. Both suits have provoked widespread criticism of G&B among librarians and scholars.

In an article in the *Chronicle of Higher Education* (October 25, 1989), which focused on the suit against APS *et al*, Patricia W. Berger, president of the American Library Association, was quoted as saying: "It looks to me like what [G&B] are trying to do is international harassment... There is no question but that this is intimidation." In the same article, Duane E. Webster, executive

director of the Association of Research Libraries, said G&B are trying to "protect their own product at the expense of freedom of inquiry." The article quoted him as saying that G&B are attempting to "create a chill on discussion, examination, and debate on serial pricing and quality, and discourage the exploration of causal factors and skyrocketing costs."

To air their views on the AMS survey, G&B took out a paid advertisement in the January 1990 issue of *Notices* (pages 92-93). G&B claim that the AMS survey contained "inconsistencies and inaccurate conclusions" because of "the use of inaccurate methodology, which results in overstatement of Gordon and Breach's prices by as much as a factor of two." In an editorial in that same issue of *Notices* (pages 2 and 18), William H. Jaco, executive director of the AMS, stated that "most of G&B's objections to the methodology are familiar ones and apply equally to most journals." G&B are free to dispute the methodology of the survey, he wrote, but they should not use letters from lawyers to "threaten the collection and dissemination of information."

G&B headquarters are in New York and London, and their major market appears to be in the U.S. and Great Britain. Yet no lawsuit has been filed in either of these countries. It is believed that G&B sued in Germany in the hope that German law, which prohibits certain kinds of "comparative advertising" that U.S. law permits, would favor their case. The AMS has learned, however, that G&B's suit against APS *et al* has just been dismissed by the German court.

At the time of this writing, the court had not yet reviewed the AMS suit. In February of this year, before it had heard full argument of the APS suit, the court did grant an injunction against further distribution of the AMS survey in Germany. The court did so based on a court appearance by G&B, made without notice to the AMS, and on various representations made by G&B to the court.

Those interested in more information about the suit may consult the following references. In *The Scientist*: "Science Publisher Sues Over Journal Pricing Survey," September 4, 1989; "Publisher Continues Its Fight Against Price Surveys," February 5, 1990; "Publisher Blocks West German Mailing of Journal," May 14, 1990. In the *Chronicle of Higher Education*: "Critics Say Publisher's Suit Inhibits Inquiries Into Rising Journal Costs," October 25, 1989; Letters to the Editor, January 3, 1990 and January 24, 1990. In *Nature*: "Battle over value of words," September 28, 1989. In *Science*: "Gordon & Breach Impanels a Journal Jury," April 20, 1990.

DMS Advisory Committee Meeting

The Advisory Committee for the Division of Mathematical Sciences (DMS) at the National Science Foundation (NSF) will hold its autumn meeting November 1-2, 1990, at NSF headquarters in Washington, DC. The Committee discusses a range of policy issues facing the DMS and provides advice on setting priorities and formulating plans.

At the last meeting, the Committee discussed the idea of small research grants, salary caps on NSF grants, the role the DMS should play in educational activities and funding priorities within the DMS, among other topics. The meeting also included a session with NSF Director Erich Bloch. Mary Wheeler of Rice University currently chairs the Committee.

The meeting is open to the public, and interested members of the mathematical sciences community are invited to attend. Suggestions for topics of discussion may be made to Judith S. Sunley, Director, Division of Mathematical Sciences, National Science Foundation, Room 339, 1800 G Street, NW, Washington, DC 20550; telephone 202-357-9669. Those wishing to attend the meeting should contact Trudy Sensibaugh at the same address and telephone number.

1990 Mathematical Sciences Department Chairs Colloquium

The 1990 Mathematical Sciences Department Chairs Colloquium, sponsored by the National Research Council's Board on Mathematical Sciences (BMS), will be held on October 19–20, 1990, in the Washington, DC area. The theme of the 1990 colloquium is "Departmental Outreach." The program is designed to provide information chairs may use to foster departmental interaction with various constituent groups and external agencies.

In addition to a broad-based panel presentation/discussion on departmental outreach, the program includes: a report by the Committee on the Mathematical Sciences in the Year 2000 (MS 2000), panels on women and minorities in mathematics, and the teaching of statistics in mathematics departments. The program also includes two panels of representatives of federal agencies that fund mathematical sciences projects: one panel will discuss programs concerned with education and the second will provide information concerning research oriented programs. Ample opportunity will be provided for personal interaction with representatives of these agencies in both formal and informal settings.

Chairpersons may be particularly interested in the workshop on renewing U.S. mathematical sciences departments based on the recent BMS report, *Renewing U.S. Mathematics: A Plan for the 1990s* (the David II Report), and related MS 2000 reports. In June a workshop involving about one dozen experienced chairpersons was held at the National Academy of Sciences. The participants developed a draft plan for renewing U.S. university mathematical sciences departments, along with materials to support briefings by chairpersons to university faculty and administrations on the report and related efforts. The

products of this workshop will be brought forward to the Chairs Colloquium. There, these materials will be discussed and refined and made available soon thereafter to all U.S. university mathematical sciences department chairpersons. The materials are intended as tools that, if widely used, should strengthen the hands of chairpersons as they work to improve support for their individual departments.

Each year, the Chairs Colloquium provides a unique opportunity for mathematical sciences department chairs, federal agency representatives, and other interested parties to meet and discuss issues of mutual concern in a pleasant and stimulating setting. The registration fee is $160 and includes all Colloquium sessions, materials, and related meals and social activities. Early registration is advised.

For further information, contact the Board on Mathematical Sciences at 202-334-2421. The mailing address is: Board on Mathematical Sciences, National Research Council, 2101 Constitution Ave., N.W., Room NAS 312, Washington, DC 20418.

Tits to Give Pitcher Lectures

The next series of Everett Pitcher Lectures will be held November 14, 15, and 16, 1990 on the campus of Lehigh University in Bethlehem, Pennsylvania. They will be delivered by Professor Jacques Tits of the College of France. The title of his lectures is *Monster and Moonshine: A Survey.*

The lectures are open to the public and are held in honor of Everett Pitcher, former Secretary of the AMS, who served in the Mathematics Department at Lehigh University from 1938 until 1978, retiring as Distinguished Professor of Mathematics. Further information can be obtained by writing Pitcher Lecture Series, Department of Mathematics, Lehigh University, Bethlehem, PA 18015, or by calling: 215-758-3753.

Tenth International Congress of Logic, Methodology, and Philosophy of Science

The Division of Logic, Methodology, and Philosophy of Science of the U.S. National Committee for the International Union of History and Philosophy of Science is seeking a host for the Tenth International Congress of Logic, Methodology, and Philosophy of Science to be held in 1995. Since the founding meeting in Stanford, California, in 1960, meetings have been held in Israel, The Netherlands, Rumania, Canada, Germany, Austria, and the USSR. It would now be appropriate for a meeting to be held at a United States based institution or consortium of institutions. Although the official invitation to hold the meeting in the United States will be issued by the National Academy of Sciences, funding of the order of $130,000 would have to be obtained from other sources. Secure financial arrangements between the host institution and the Academy must be in place well before the next DLMPS meeting in August 1991. Realizing that it may prove impossible to find an appropriate host in time for the 1995 meeting, the U.S. National Committee also encourages suggestions for the Eleventh Congress in 1999. For further information:

Milton A. Whitcomb, Staff Officer
U. S. National Committee for the
International Union of History
and Philosophy of Science (HA 186)
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D.C. 20418
Telephone: 202-334-3022

Visiting Scientist Guidelines Available

The Visiting Scientist Program of the Colorado Alliance for Science has published "Guidelines for Your Visiting Scientist Program," which provides advice for programs in which scientists donate their time and expertise to assist classroom teachers. The Alliance's program has been running in schools in four Colorado cities since 1983.

Among the main aspects of the Colorado program are: (1) a scientist or engineer from industry donates two to five hours per week to a teacher or department; (2) work may be done at any grade level; (3) teacher/scientist teams collaborate on plans for projects; (4) the team continues its efforts for at least one school year; (5) evaluation is an ongoing process between the teacher and the scientist.

There is considerable evidence from the Colorado experience that such programs can enhance student learning, teacher effectiveness, and communication between industry and schools. To obtain a copy of the guidelines, write to: James H. Hubbard, Associate Director, Colorado Alliance for Science, Campus Box 249, University of Colorado, Boulder, CO 80309.

Mathematics Awareness Week 1991

April 21-27

Right on the heels of Mathematics Awareness Week 1990, plans are being made for next year's celebration of the richness and relevance of mathematics. Dates for 1991 are April 21-27 and the theme will focus on the uses of mathematics.

The Office of Governmental and Public Affairs (OGPA) of the Joint Policy Board of Mathematics is seeking slogans and art work for this "applications" theme.

Please send your ideas by **September 30, 1990** to: OGPA, 1529 18th Street, N.W., Washington, DC 20036.

The originator(s) of the chosen theme and art work will receive credit on printed materials as well as a free supply of posters and postcards.

News from the Institute for Mathematics and Its Applications

University of Minnesota

The 1990-1991 academic year program at the Institute for Mathemat-

ics and Its Applications (IMA) is Phase Transitions and Free Boundaries. The organizers for this program are: R. Fosdick, M.E. Gurtin, W.-M. Ni, and L.A. Peletier. The advisory committee is: H. Brezis, L.A. Caffarelli, D. Kinderlehrer, and J. Serrin. The aim of the program is to understand certain types of physical behavior which occur in phase transitions and in phenomena which involve free boundaries.

The first half of the year will be concerned with phase transitions and will concentrate on equilibrium and dynamical problems involving two or more phases, with the transition region a sharp interface or a transition layer. The program will begin September 10-14 with a tutorial, *The Evolution of Phase Boundaries*, organized and led by M. Gurtin. The goal of this minicourse is a coherent treatment of the continuum mechanics and thermodynamics of evolving phase boundaries. The tutorial will be followed immediately by the workshop *On the Evolution of Phase Boundaries*, September 17-21, organized by Gurtin and G. McFadden.

During October 15-19 the IMA will offer the workshop *Shock Induced Transitions and Phase Structures in General Media*, organized by R. Fosdick, E. Dunn, and M. Slemrod. This workshop will focus on the thermodynamics and mechanics of dynamic phase transitions that are mainly inertially driven.

On November 12-16 the workshop *Microstructure and Phase Transition* will be held, organized by D. Kinderlehrer, R. James, J.L. Ericksen, and M. Luskin. The emphasis here will be the discussion of phase transitions, defect structures and metastability, especially in solids, from the viewpoint of experiment, constitutive theory, and the development and use of numerical results to reconcile experiment with theory.

The phase transitions portion of the program will conclude with the workshop *Statistical Thermodynamics and Differential Geometry of Microstructured Material*, (January 21-25, 1991), organized by H.T. Davis and J.C.C. Nitsche. The purpose is to bring together researchers interested in the generation of statistical mechanical free energy theories which predict the appearance of the various microstructures, in the development of the topological and geometrical methods needed for a mathematical description of the subparts and dividing surfaces of heterogeneous materials, and in the development of modern computer-aided mathematical models and graphics for effective exposition of the salient features of microstructures materials.

At present, the IMA is running a 1990 summer program *New Directions in Time Series Analysis* (July 2-27), organized by E. Parzen, D. Brillinger, M. Rosenblatt, M. Taqqu, J. Geweke, and P.E. Caines. The weekly topics are non-linear models, self-similar processes & long range dependence, interactions of time series & statistics, and time series research common to engineers & economists.

For more details concerning the summer and academic year programs, contact the IMA at Institute for Mathematics and its Applications, University of Minnesota, 514 Vincent Hall, 206 Church St. S.E., Minneapolis, MN 55455-0436; 612-624-6066.

News from the Mathematical Sciences Institute

Cornell University

A workshop on Partial Differential Equations is planned for October 5-7, 1990 at the Mathematical Sciences Institute (MSI). Organized by Alfred Schatz and James Bramble of Cornell University, this workshop honors the contributions of Lawrence E. Payne during his 25 years as a professor in Cornell's Department of Mathematics. Topics to be discussed within the general area of partial differential equations include: non well-posed problems, isoperimetric inequalities, and finite time blowup. The workshop will be held at Cornell University. For information about scientific content, contact A. Schatz, Department of Mathematics, Cornell University, Ithaca, NY 14853; 607-255-2318; schatz@mssun7.msi.cornell.edu. To attend the workshop, contact the Mathematical Sciences Institute, 201 Caldwell Hall, Cornell University, Ithaca, NY 14853; 607-255-8005.

News of the MSI, including workshop overviews, can be received free of charge in its newsletter Mathematical Sciences Institute News; write to John Chiment at MSI, 223 Caldwell Hall, Cornell University, Ithaca, NY 14853. A summary of the invited talks and of the panel discussion which took place at the March "Mathematics as a Consumer Good" symposium (*Notices*, November 1989, page 1218) is now available from MSI at the address in the first paragraph.

Italian Society of Applied and Industrial Mathematics

The Italian Society of Applied and Industrial Mathematics (SIMAI) has been established to encourage the development of applied and industrial mathematics and related disciplines. The aim is to facilitate interactions among universities, research institutions, and industries in the various fields of applied mathematics. In this connection, SIMAI is particularly concerned with the development of mathematical models, the study of their qualitative properties, and the numerical and computational questions they pose.

SIMAI also intends to develop programs to train young mathematicians, to update senior researchers in applied and industrial mathematics, and plans to develop postgraduate courses, interdisciplinary study groups, and a program of grants for young researchers. In addition, SIMAI will publish a newsletter, encourage national and international symposia and seminars, and may

eventually publish texts growing out of its educational programs.

For more information about SIMAI, contact: A. Tesei, c/o Instituto per le Applicazioni del Calcolo "M. Picone," Viale del Policlinico 137, I-00161 Roma, Italy.

Mathematics Education Centre, Auckland

The Mathematics Education Centre, Auckland (MECA) was formed in 1989 to act as a focus both for mathematical education and for the users of mathematics within industry, commerce, and the community. Involving a wide range of education groups, the Centre supports all aspects of mathematics education, with an emphasis on research, professional development for teachers, and resource development. In addition, MECA works with communities to promote mathematics teaching and learning, and publishes regular newsletters.

MECA also issues *MECATALK*, which appears three times per year. For more information about MECA, write to: Jill Ellis, Director, MECA, c/o Auckland College of Education, Private Bag, Symonds Street, Auckland, New Zealand; telephone 09-687-009.

Linear Algebra Society Formed

The International Linear Algebra Society (ILAS) was formed during the Combinatorial Matrix Analysis Conference in Victoria, Canada, in May 1987. Encompassing all applications of linear algebra, as well as theoretical matrix analysis and abstract linear algebra, ILAS is designed to encourage and support such activities as meetings and publications.

The inaugural ILAS meeting took place in Provo, Utah, in August 1989. Other ILAS conferences are being planned, and ILAS is also sponsoring several other linear algebra conferences. Other ILAS activities include: publication of *Image*, a bulletin which provides a forum for discussions and opinions; ILAS-NET, an electronic news service which transmits announcements of ILAS activites and other news of interest to linear algebraists; and ILAS Information Center, an on-line system providing information on international linear algebra conferences and on linear algebra journals, as well as other news.

More information about ILAS is available through email, by sending the message "send gen_info from ilas" to iic@water.uwaterloo.edu or to iic@water.waterloo.edu. Or contact Danny Hershkowitz, ILAS Secretary, Mathematics Department, Technion–Israel Institute of Technology, Haifa 32000, Israel; email mar23aa@technion.bitnet.

Committee Addresses Mathematics in Genome Project

The Societal Institute of the Mathematical Sciences (SIMS) has organized a steering committee to address the role of the mathematical sciences in the Human Genome Project. The committee will monitor rapid developments in the project and related fields which particularly concern the mathematical sciences and will recommend or initiate research and education programs when desirable or necessary.

"The understanding of DNA and protein sequences and structure is perhaps the most fundamental problem facing biology today," says one of the committee members, James G. Glimm of the State University of New York at Stony Brook. "A number of areas of mathematics have proven to be relevant to this kind of problem: analysis, combinatorics, computer science, discrete optimization, mathematical and dynamic programming, numerical analysis, probability, statistics, stochastic processes, and topology." Another committee member, Samuel Karlin of Stanford University, notes that "there are great opportunities for mathematicians, statisticians, and computer scientists to bring their unique and creative scientific approaches to theoretical and data analysis problems of the Human Genome Project and make useful contributions."

It is anticipated that the committee will meet five times during the period 1990-92. A written record will be prepared following each meeting and made available to those interested. SIMS, founded in 1973 as a non-profit institute, conducts conferences and research and education programs in the application of the mathematical sciences to societal issues. For more information, write to: SIMS, 97 Parish Road South, New Canaan, CT 06840.

Hotline for NSF Vacancies

The National Science Foundation has installed a Vacancy Hotline, which lists all current vacancies in staff positions. For those in the District of Columbia metropolitan area, the local hotline number is 202-357-7735; others may call 800-628-1487.

NSF Links Researchers to Japan

The National Science Foundation (NSF) is offering U.S. scientists and engineers access to scientific information from Japan. In cooperation with Japan's National Center for Science and Information Systems (NACSIS), the NSF provides, at no charge, online access to the science databases associated with Japan's Ministry of Education, Science, and Culture.

As of March 1990, ten databases were available, including Grant-in-Aid Research Reports, Conference Papers of Academic Societies and Associations, and Index to Dissertations. The NSF will, at the request of a researcher, perform a search and summarize the findings in English. Or, researchers may arrange to come to NSF headquarters in Washington, DC, to use the facility in person.

For more information, contact: NACSIS Search Operator, Room 416-A, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; telephone 202-357-7278.

Report Finds Data Lacking on Teacher Quality

News headlines warn of shortages of mathematics and science teachers, but a panel of the National Research Council says that quantity is not the only issue. Quality is equally, if not more, important in understanding the state of the nation's precollege mathematics and science education. The panel's report concluded that too little is known about the quality of mathematics and science teachers in the United States and recommended improved data collection through extensive surveys administered on a regular basis. The report is the result of a thirty-month review that included in-depth studies of thirty-nine school districts across the nation.

The report states that more must be done to collect and analyze data on all aspects of the pool of mathematics and science teachers, from the reasons teachers leave the field to information on the hiring practices of school systems. Of primary concern is the lack of frequent and detailed attrition data, needed to predict the demand for teachers, the report notes. Population projections help school districts determine the number of teachers needed for a given year, but it is much more difficult to predict the numbers of qualified teachers available. Frequently, school districts adjust to changes in supply and demand by lowering their hiring standards or shifting teachers from one subject area to another. Such adjustments can dramatically change the quality of instruction.

The report recommends that school districts be surveyed regularly by the U.S. Department of Education's National Center for Education Statistics. Addressing the shortage of minority teachers is also a priority. The report, "Precollege Science and Mathematics Teachers: Monitoring Supply, Demand, and Quality," is available for $25 (prepaid) from the National Academy Press, 2101 Constitution Ave., Washington, DC 20418; 202-334-3313 or 800-624-6262.

Brochures on Graduate Support Available

To help address the decline in the number of students expressing interest in graduate school, the National Science Foundation (NSF) has prepared a brochure, "Thinking of Graduate School?". This handy brochure briefly describes various graduate fellowship opportunites available through the NSF. Colleges and universities nationwide are being asked to distribute the brochures to alert juniors and seniors in science, mathematics, and engineering to these fellowship opportunities.

These brochures are available free of charge from the National Research Council. To order copies, send your name, institution, department, and address to: Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington, DC 20418. Please indicate the number of copies desired.

NOMINATIONS FOR THE 1991 FULKERSON PRIZE

This is call for nominations for the D. Ray Fulkerson Prize in discrete mathematics that will be awarded at the XIVth International Symposium on Mathematical Programming to be held in Amsterdam, The Netherlands, August 5 - 9 1991.

The specifications for the Fulkerson Prize read:

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

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

The nominations for the award will be presented by the Fulkerson Prize Committee (Martin Grötschel, Chairman, Louis Billera, and Paul D. Seymour) to the Mathematical Programming Society and the American Mathematical Society.

Please send your nominations by ***January 15, 1991*** *to:*

Professor Dr. Martin Grötschel
Institute of Mathematics, University of Augsburg, Universitätsstr. 8, 8900 Augsburg, West Germany

Funding Information for the Mathematical Sciences

AMS Centennial Fellowships Invitation for Applications, 1991-1992
Deadline December 1, 1990

These fellowships are intended to provide enhanced research opportunities to mathematicians who are several years past the Ph.D., who have a strong research record, but who have not had extensive postdoctoral research support in the past. Applicants should have received the Ph.D. degree between January 1, 1979, and December 31, 1984, and should not have had the equivalent of more than two years of full-time postdoctoral support.

The stipend for fellowships awarded in 1991-1992 has been set by the Trustees of the Society at $38,000 for nine months. In addition, there will be an expense allowance of $1,200. Applicants must be citizens or permanent residents of a country in North America. The fellowship may be combined with other stipends and/or part-time teaching; this option can be used to extend the award to cover a period of up to two years. For further information about the acceptability of such arrangements, individuals should contact the Secretary of the Society.

The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Trustees have arranged a matching program from general funds in such fashion that funds for at least one fellowship are guaranteed. Because of the generosity of the AMS membership it was possible to award three fellowships a year for the past three years (1988-1989, 1989-1990, and 1990-1991).

The deadline for receipt of applications is **December 1, 1990**. Awards will be announced in February 1991, or earlier if possible.

For application forms, write to the Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940. (It should be noted that completed application and reference forms should NOT be sent to this address, but to the address given on the forms.)

NSF Proposal Format Changes - Update

The October 1989 issue of *Notices* carried an announcement concerning a number of changes in the format of proposals submitted to the National Science Foundation. The purpose of the changes was to address two issues: the quality of publications of the investigators and the educational impact of the proposed research. One of the changes was to limit to ten the number of publications listed on the proposal.

The Foundation has announced that, until further notice, the proposal format changes have been suspended. In particular, every investigator is encouraged to include in his or her vita a complete list of publications.

New Program for Women Faculty

The National Science Foundation has launched this year a new program to recognize the nation's most outstanding and promising women scientists, mathematicians, and engineers who are engaged in academic research and teaching. The Faculty Awards for Women program will make up to 100 five-year grants of $50,000 per year to support research activities.

Nominations for the awards must be made by a sponsoring institution. To be eligible, nominees must be U.S. citizens, hold a Ph.D. (or an equivalent degree), and be tenured but not yet full professors (or the equivalent rank). There is no limit on the number of nominees from an institution, but there should be only one nominee per department.

Institutions are expected to make a significant commitment to the support of their awardees, including full academic-year salary for the awardee. Up to 10% of the funds may be used to defray administrative expenses in lieu of direct costs.

The deadline for submission of nominations is **September 1, 1990**. The Division of Research Initiation and Improvement will be coordinating the program in the Foundation; the contact person there is Jean Van-

ski, 202-357-7552. In addition, the staff of the Office of Special Projects in the Division of Mathematical Sciences would be happy to answer questions about the program (202-357-3453).

Deadlines for International Programs

The National Science Foundation (NSF) has several programs supporting international collaborative research in science and engineering. These programs provide support for various kinds of projects, including cooperative research between individual investigators, long- and medium-term research visits for young researchers, and research-oriented seminars or workshops.

The Bilateral Cooperative Science Programs support cooperative research, seminars or workshops, and long-term visits (4–12 months) in Austria, Germany, the Netherlands, Denmark, Finland, Norway, Sweden, the United Kingdom, and Switzerland. For more information, contact Christine French or Christine Glenday, Division of International Programs, 202-357-9700. The deadline is **September 15, 1990.**

The Science in Developing Countries program supports short-term planning visits, collaborative research, seminars, and dissertation improvement of graduate students in developing countries. For more information contact Ed Field (North Africa and Turkey), 202-357-9402; Osman Shinaishin (South and West Asia), 202-357-9402; Gerald Edwards (East Asia), 202-357-9537; Harold Stolberg or David Kelland (Latin America and the Caribbean) 202-357-7421. Though proposals may be submitted at any time, the next target date is **September 1, 1990.**

Presidential Young Investigators Competition for 1991

Each year, the National Science Foundation (NSF) offers cooperative research support to 200 of the nation's most promising young science, mathematics, and engineering faculty, through the Presidential Young Investigators program. In past years, these prestigious awards have totaled $25,000 plus an additional $37,500 on a dollar-for-dollar basis if matched with contributions from industrial sources. Total possible annual support is $100,000.

Nominations must be made by U.S. institutions granting degrees in fields supported by the NSF. Although the program announcement was not available at the time of this writing, it is anticipated that the guidelines for the program will be similar to previous years. In particular, nominees must be no more than five years from the Ph.D. and must have begun their first tenure-track positions at eligible institutions within the last three years.

The application deadline is **October 1, 1990.** For a program announcement and more information, contact: Presidential Young Investigators Program, Room 630, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; telephone 202-357-9466.

Deadline for Research Experiences for Undergraduates

As part of ongoing efforts to enhance undergraduate experience in the mathematical sciences and stimulate students' interest in research careers, the Division of Mathematical Sciences (DMS) of the National Science Foundation sponsors the Research Experiences for Undergraduates (REU) program. One component of the program, the REU Sites, gives students an opportunity to participate in the excitement of research in intensive summer programs.

The REU Sites funded by DMS have been highly successful in attracting talented students and in providing them with challenging projects. Rather than providing additional coursework, the REU Sites are designed as enrichment experiences that give students a taste of mathematical sciences research.

Out of sixteen new proposals for REU Sites for the summer of 1990, there were nine new awards; there were also six continuing awards. The total DMS budget for the REU Sites is around $0.5 million for fiscal year 1990. A list of the grantees, together with the titles of their projects, can be found in *Notices*, February 1990, page 141.

According to John V. Ryff, program director for REU in DMS, some of the guidelines for the program have changed slightly. Applicants need not confine budgets to the $4000 per-student average. In addition, the DMS will now consider faculty salary and equipment requests along with student stipends. Meeting such requests is contingent upon budget flexibility within the DMS; however, Ryff notes that the DMS is currently planning to expand the REU Site program. The DMS strongly encourages proposals from all segments of the mathematical and statistical communities, and proposals for REU Sites in mathematical statistics are especially welcome.

The deadline to submit proposals for the 1991 REU Sites is **October 10, 1990.** For more information, contact John V. Ryff, Program Director, Research Experiences for Undergraduates, Division of Mathematical Sciences, Room 339, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; telephone: 202-357-3456; electronic mail: jryff@note.nsf.gov (Internet) or jryff@nsf (Bitnet).

Deadline for NSA Research Proposals

The National Security Agency (NSA) awards research grants to universities in the areas of algebra, number theory, discrete mathematics, probability, and statistics. For standard research proposals designed principally to provide summer salary for professors and support for graduate students, the next deadline is **October 15, 1990.** Grants awarded from

this funding cycle can expect to incur expenses by June 1, 1991.

The NSA also accepts proposals for small grants for conferences, workshops, and special academic endeavors in the above five areas of mathematics. In previous years, these had a deadline of May 1, but now there will be **no deadline** for these types of proposals. The proposals will be accepted, reviewed, and funded as they are received at NSA. Those submitting the proposals should allow 7 to 8 months of review time before grants can be made.

For further information about the program, please call 301-859-6659 or write to Marvin C. Wunderlich, Director, Mathematical Sciences Program, National Security Agency, Attn. RMA, Ft. George G. Meade, MD 20755-6000. Queries can also be made by email at mcw@cs.umd.edu.

Mathematical Sciences Postdoctoral Research Fellowships

The National Science Foundation's (NSF) Mathematical Sciences Postdoctoral Research Fellowship program is designed to permit recipients to choose research environments that will have maximal impact on their future scientific development. Awards will be made for appropriate research in pure mathematics, applied mathematics and operations research, and statistics at an appropriate nonprofit United States institution.

The fellowships will be offered only to persons who 1. are U.S. citizens or nationals as of January 1, 1991; 2. will have earned, by the beginning of their fellowship tenure, a doctoral degree in one of the mathematical sciences; 3. will have held the doctorate for no more than five years as of January 1, 1991; and 4. will not previously have held any other NSF postdoctoral fellowship. The evaluation of applicants will be based, in part, on ability as evidenced by past research work and letters of recommendation, likely impact on the future scientific development of the applicant, and scientific quality of the research likely to emerge. Applicants' qualifications will be evaluated by a panel of mathematical scientists.

For copies of the application brochure or further information, contact the Special Projects Program, Division of Mathematical Sciences, National Science Foundation, 1800 G Street, NW, Washington, DC 20550; telephone 202-357-3453; or the American Mathematical Society at telephone 401-455-4000.

The deadline for applications is **November 15, 1990.**

Travel Grants for Logic Congress

Travel grants will be available for the IX International Congress of Logic, Methodology and Philosophy of Science, which will be held in Uppsala, Sweden August 7-14, 1991. The grants are available from the International Union of the History and Philosophy of Science, under the aegis of the National Academy of Sciences.

An applicant must submit an application form together with a curriculum vitae, a list of recent publications, and an abstract of the paper to be presented at the Congress. Although acceptance of a paper at the Congress is not necessary to apply, the travel awards are conditional upon obtaining confirmation of receipt and acceptance of the paper. Applicants must be U.S. citizens.

The deadline for receipt of applications is **January 2, 1991**. For copies of the application form, contact: Milton A. Whitcomb, Staff Officer, National Reserch Council, U.S. National Committee for the International Union of the History and Philosophy of Science, 2101 Constitution Avenue (HA 186), Washington, DC 20418; telephone 202-334-3022.

Probability Theory, Function Theory, Mechanics

Yu. V. Prokhorov, Editor (Proceedings of the Steklov Institute, Volume 182)

This is a translation of the fifth and final volume in a special cycle of "Trudy of the Steklov Mathematical Institute ofthe Academy of Sciences," published in commemoration of the 50th anniversary of the Institute. The purpose of the special cycle of publications was to present surveys of work on certain important trends and problems pursued at the Institute. Because the choice of the form and character of the surveys was left up to the authors, the surveys do not necessarily form a comprehensive overview, but rather represent the authors' perspectives on the important developments.

The survey papers in this collection range over a variety of areas, including: probability theory and mathematical statistics, metric theory of functions, approximation of functions, descriptive set theory, spaces with an indefinite metric, group representations, mathematical problems of mechanics, and spaces of functions of several real variables and some of its applications.

1980 Mathematics Subject Classifications: 01, 04, 22, 34, 41, 42, 46, 62, 73, 76, 93 and others
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For Your Information

Mathematical Sciences in the FY 1991 Budget*

Joint Policy Board for Mathematics
Hans J. Oser

Overview and General Trends

The substantial increases in support of research in mathematical science during the 1980s have generally given way to a more modest growth as seen in the proposed fiscal year 1991 federal budget. During the early eighties many funding agencies experienced annual growth rates in excess of 10 percent in their mathematics programs. In the past few years, however, the worsening federal deficit, combined with the effects of the Gramm-Rudman-Hollings legislation, has substantially cut the rate of increase for these programs.

Although the National Science Foundation (NSF) has convinced the Administration again that the overall NSF budget should double by 1993, the last three years' experience urges caution on whether NSF can expect the 14 percent increase they are asking for. The oversight committees in both Houses of Congress have been sympathetic in recent years to the idea of doubling NSF's budget over a five-year period, but the prevailing budget realities have forced Congress to deny the Administration's request for three years in a row. Besides the Gramm-Rudman-Hollings legislation, the jurisdictional boundaries of the appropriations subcommittees in both Houses have been the most serious obstacle to granting NSF the special status that it would seem to deserve as one of the nation's major sources of support for basic research in science and engineering. NSF has suffered from the annual tug of war between its own budget request, the space program, and those highly visible programs for national housing for veterans' affairs, the latter now a cabinet-level department.

Neither the Department of Energy nor the funding agencies in the Department of Defense predict dramatic increases in support of R&D programs, although basic research appears to come off better than many applied research and technology development programs.

The fragmentation of congressional responsibility concerning science and technology programs has prevented a meaningful dialogue on national R&D policy. This situation has frustrated members of the academic world who would like to see Congress discuss the issues of big science versus little science, the balance between defense-sponsored and civilian research, the growth, in numbers and size, of science, and technology centers versus single-investigator grants, as well as the potential impact of adding technology policy to NSF's duties.

Trends in Federal Support for Mathematics Between 1982-1990

In the NSF, mathematics has fared relatively well in the past eight years. Growth in the Division of Mathematical Sciences (DMS) during this period was 85 percent (in constant dollars) and even higher when mathematics-related support in other directorates is counted. Most of these increases went into development of an undergraduate mathematics curriculum. In FY 1991, the DMS is asking for a 6.7 percent increase (in current dollars), which is the second-highest in the Mathematical and Physical Sciences Directorate (MPS), after astronomy. Beginning in FY 1991, the NSF budget contains a new line item for facilities, for which $20 million is being requested. Within MPS, those funds will be directed towards upgrading laboratory facilities in physics, astronomy, and materials science, none for mathematics.

In the Defense Department, the former rapid growth in support of basic research has declined to a modest 4 percent in FY 1991. How this overall increase in the so-called 6.1 programs will show up in the FY 1991 mathematical sciences programs in ARO, AFOSR, ONR, NSA and DARPA is not yet evident. Most of the DOD program managers indicate a practically level budget for 1991 compared to 1990. The overall growth in support of mathematics since 1982, in constant dollars, was 73 percent, but that growth has been quite uneven as we examine the five funding agencies more closely. NSA and DARPA did not directly fund mathematical science

*This report was prepared for the Joint Policy Board for Mathematics and as part of the *AAAS Report XV: Research and Development, FY 1991*, April 1990.

research in the universities prior to 1984. AFOSR and ARO show (constant-dollar) increases of 86 and 51 percent, respecitvely, while ONR suffered a 13 percent decline during the same period.

The Department of Energy is requesting an 11 percent increase in its mathematical sciences program for FY 1991. Past experience suggests that the final outcome will probably be closer to half that amount. The DOE Applied Mathematical Sciences Program supports both mathematics and computer science and divides its $25 million budget about equally between the two disciplines. About half of the budget supports university-based research projects, the other half is channeled through the DOE National Laboratories. The mathematics support directed to the universities, in constant dollars, grew by an astounding 125 percent since 1982, the highest of any of the agencies covered in this survey. This DOE program also underwrites the Wilkinson Fellowship at Argonne National Laboratory, the Lewy Fellowship at Berkeley, and the Householder Fellowship at Oak Ridge National Laboratory, all fellowships that enjoy considerable prestige in the mathematics community.

Highlights of Mathematics Programs in FY 1990

The Army Research Office announced on August 24, 1989 that it had made a 5-year, $66.9 million award to a consortium, led by the University of Minnesota, to establish an Army High Performance Computing Research Center on the Minneapolis Campus. The program envisioned by the Army will include research in the mathematical sciences, computer engineering, and physical and biological sciences. Other participants in this new center, besides the Univeristy of Minnesota, are the Massachusetts Institute of Technology, Howard University, and Purdue University. The center is expected to be fully operational in the Spring of 1990. Initially, access will be made available to super-computers such as the CRAY-2 and CRAY-XMP, later to be augmented by an aggressive equipment acquisition of massively parallel machines, high-performance workstations, and a visualization laboratory. The equipment budget during the 5-year lifetime of the project is $27.3 million, the research budget is $8.5 million, and infrastructure support will get $31.1 million. The director of the center is George Sell, the scientific direction is provided by David Kinderlehrer in the School of Mathematics at Minnesota.

Automatic Gramm-Rudman-Hollings cuts forced NSF to postpone the start of new science and technology centers in FY 1990. The collapse of ETA-Systems, the Control Data Corporation's supercomputer subsidiary, led to an NSF decision in the directorate for Computer & Information Science and Engineering (CSE) to phase out support for the John von Neumann Center at Princeton University during the current fiscal year. The four remaining supercomputer centers (Illinois, Cornell, Pittsburgh, and San Diego) will receive hardware and software upgrades in both FY 1990 and FY 1991.

Proposed Agency Programs in the 1991 Budget

Each funding agency provides support for a variety of programs including institutes, individual and group awards, equipment awards, and special programs in support of women and minority students. In addition, all agencies are funding a variety of cross-disciplinary programs, such as infrastructure support, equipment awards, fellowships for faculty and graduate students (including women and minority fellowships), and so-called small institution awards. Agency programs are also involved in cooperative funding arrangements across disciplines and sometimes jointly with other agencies. These include industrial, university, and laboratory cooperative programs. For these reasons it is very difficult to make precise statements about the level of funding for mathematical sciences research per se, since many of the funding agencies in DOD, NASA, and in DOE often describe their programs by projects and not by discipline.

Personnel changes have been quite minimal during the past year. The new director of the mathematics division in ONR is Neil Gerr who had been acting director of the division since the departure of John Cannon. Several new program directors were appointed in NSF, AFOSR, ONR and ARO.

A. National Science Foundation. Within the Mathematical and Physical Sciences Directorate (MPS), the FY 1991 request for mathematical sciences of $73.72 million is up from $69.12 million in 1990, a 6.7 percent increase in current dollars. The additonal funds are for the Special Projects activity (undergraduate course and curriculum development, alliances for minority participation, and faculty awards for women), and in the programs area an increase of 20 new investigators, more support for graduate students and equipment, and strengthened research support in areas of opportunity, such as interaction with other disciplines, computational mathematics, and the incorporation of geometric ideas and methods throughout the mathematical sciences.

Both MPS and CSE have substantial increases for science and technology centers in their budget requests for next year, totalling $15.25 million. The awards will not be made until late 1990, when the allocation to particular disciplines will be known.

B. Air Force Office of Scientific Research (AFOSR). Mathematical sciences research is supported within the Mathematical and Information Sciences Directorate. Support for mathematics is expected to increase from $16.5 million in fiscal year 1990 to $17.5 million in fiscal year 1991. Included in this figure are $3 million for multidisciplinary and research interaction awards under the University Research Initiative Program and

about $1 million going to support research in the Air Force laboratories. Major program areas supported by the AFOSR are nonlinear dynamics and control theory, optimization, finite mathematics, signal processing and communication, probability and statistics, and physical mathematics. There is an exploratory research program in wavelets.

C. Army Research Office (ARO). The Army High Performance Computing Research Center (AHPCRC) at the University of Minnesota is now in its first full fiscal year of operation. The research program at AHPCRC is directed towards mathematical and computer sciences, physics and biology. Programmatic thrusts are in the materials sciences, real-time control, computer science aspects in large-scale computing and in the biomedical sciences. ARO also supports the Mathematical Sciences Institute at Cornell University and the Center for Intelligent Systems at Brown and Harvard Universities.

D. Office of Naval Research (ONR). The Mathematical Sciences Division's program is divided into six areas: applied analysis, discrete mathematics, numerical analysis, operations research, probability and statistics, and signal analysis. The core program in FY 1990 is $7 million and is expected to increase to almost $8 million in 1991. The accelerated research initiatives (ARI) are short-term programs with typically a five-year lifetime. Their share of the mathematics budget this year is 4 million and is expected to go up to $4.8 million in FY 1991. The total budget of the division will thus increase from $11 million to $12.7 million in FY 1991, a growth of over 15 percent in current dollars. This is the first substantial increase in several years for the mathematics program at ONR.

E. Defense Advanced Research Programs Agency (DARPA). Unlike the funding agencies of the three DOD Services, i.e., AFOSR, ARO, and ONR, the DARPA program is directed towards advanced technology development. Mathematical research is but one tool in the arsenal of techniques employed to further DARPA's goals. Furthermore, the distinction between applied mathematics, computer science and computer engineering is an exceedingly difficult one to draw in this environment. Consequently, the allocation of the agency's budget to particular disciplines is not entirely satisfactory in this case.

In FY 1990 the Applied Computational and Mathematics Program has a total budget of $12 million. This program is primarily directed toward four specific areas. They are (1) modeling and simulation, (2) algorithmic development, (3) digital signal processing, and (4) intelligent control. This latter category of research is directed towards those aspects of control theory where the environment cannot be described by ordinary differential equations any more but has to be determined through modeling, simulation and heuristics. That also involves the use of artificial intelligence (AI) methods for data management.

In digital signal processing, new tools are being developed, such as wavelets, Gabor bases, and Wigner transforms. Data fusion is a technique that is being used to combine information from the data to which different computations have been applied.

Algorithm development aims at codes for distributed systems, among them non-iterative algorithms for number-crunching in linear algebra problems. Another goal is the automation of optimal code generation that will match given algorithms to a particular machine.

F. National Security Agency (NSA). NSA's mathematical sciences program experienced a substantial increase from fiscal year 1989 to 1990, from $2.9 million to $3.2 million, or more than 10 percent. The outlook for fiscal year 1991 appears to be for a level budget.

The mathematical sciences program at NSA went public in 1984. It supports research in algebra, number theory, discrete mathematics, statistics and probability. Due to the nature of its work, the agency continues to be concerned about the supply of U.S. citizens for its ongoing mission.

G. Department of Energy (DOE). The Applied Mathematical Sciences program in the DOE Office of Energy Research serves two distinct roles. Mathematical sciences research is aimed at understanding models arising in DOE research and development programs and to provide supercomputing resources to DOE's researchers. Growth of these programs continued in 1989 and 1990. The applied mathematical sciences research program funds basic research in the national laboratories, universities, and private research institutions, in these categories: analytic and numerical methods, computational statistics, information analysis techniques, and advanced computing concepts for parallel architectures and languages. Topical areas of mathematics that are supported include: applied analysis, discrete mathematics, statistics and probability, linear algebra, optimization and control, geometry, dynamical systems, and nonlinear analysis.

Support for computer science and mathematics is split about evenly between U.S. universities and the DOE National Laboratories (which happen to be managed by universities in several cases). The dollar figures in this chapter reflect only the research support for the mathematical sciences. For computer science, see the appropriate chapter in the *AAAS Report XV*.

The table on the next page shows the budgets for the years between 1983 and 1991 for the federal agencies that have supported mathematical research. As before, we have updated some of the figures from prior years as better information has become available.

H. Other Federal Agencies. Several agencies, such as the National Aeronautics and Space Administration and the National Institutes of Health, support mathemati-

cal sciences programs, though mostly in-house. NASA also supports the Institute for Computer Applications in Science and Engineering in Langley, VA, with a budget of approximately $1 million annually. The National Institute of Standards and Technology, as well as numerous national laboratories in other federal agencies, conduct substantial in-house mathematics, statistics, and computer science research programs.

FEDERAL AGENCY SUPPORT IN THE MATHEMATICAL SCIENCES (IN MILLIONS OF DOLLARS), 1983 – 1991

	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90	FY 91
NAT' l. SCIENCE FOUNDATION									
DMS	34.10	41.20	47.50	51.74	59.42	63.76	66.02	69.12	73.72
Other (1)	3.00	4.00	5.00	5.50	5.00	5.50	8.00	8.00	10.00
Total NSF	37.10	45.20	52.50	57.24	64.42	69.26	74.02	77.12	83.72
DEPT. OF DEFENSE (2)									
AFOSR	7.30	10.20	11.82	13.30	15.30	14.30	16.45	16.50	17.50
ARO	6.50	6.80	7.50	8.40	9.70	10.60	11.50	12.00	12.00
ONR	12.70	11.90	11.98	12.81	11.30	11.50	12.02	12.70	14.13
DARPA	*	*	1.00	5.50	9.20	12.00	12.00	12.00	12.00
NSA	*	1.02	1.32	1.62	1.90	2.31	2.86	3.20	3.20
Total DOD	26.50	29.92	33.62	41.63	47.40	50.71	54.83	56.40	58.83
DEPT. OF ENERGY (3)									
University Support	2.80	2.90	3.50	3.94	4.30	5.90	5.70	6.40	6.50
Nat'l. Laboratories	3.90	4.30	5.10	5.80	5.50	5.90	6.50	6.50	7.00
Total DOE	6.70	7.20	8.60	9.74	9.80	11.80	12.20	12.90	13.50
OTHER AGENCIES	2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00
TOTAL NON-NSF	35.20	39.12	44.22	53.37	58.20	63.51	68.03	70.30	73.33
GRAND TOTAL-All Agencies	72.30	84.32	96.72	110.61	122.62	132.77	142.05	147.42	157.05

(1) Includes estimates for S/T Centers after FY 1988
(2) Some DOD programs include University Research Initiatives (URI)
(3) The DOE Mathematical Sciences Program also supports computer science programs at about the same level

1990 AMS Elections

Council Nominations
Vice-President, Trustee and Members-at-Large

One vice-president, one trustee and five members-at-large of the Council will be elected by the Society in a contested election in the fall of 1990.

The vice-president will serve for a term of two years effective January 1, 1991. The Council has nominated two candidates for the position, namely:

Chandler Davis — Hans F. Weinberger

The trustee will serve for a term of five years effective January 1, 1991. The Council has nominated two candidates for the position, namely:

Jane Gilman — M. Susan Montgomery

The five members-at-large will serve for a term of three years. The Council nominated seven candidates. They are:

David A. Cox
John M. Franks
Kunio Murasugi
Donald St. P. Richards
Lesley M. Sibner
Ruth J. Williams
Lai-Sang Young

If nominations by petition have not appeared bringing the total number of candidates to at least ten, it will be brought up to ten by the Council.

The deadline for petitions is July 6. Such proposals will not reach the Council for action until the August Council meeting.

President's Candidates
Nominating Committee

Three members of the Nominating Committee are to be elected in the fall of 1990 to serve for a term of three years. Continuing members are:

Joan S. Birman
James E. Humphreys
Barbara Lee Keyfitz
Victor Klee
Ray A. Kunze
Alan D. Weinstein
Robert Williams

President William Browder has named six candidates for the other three places. They are:

Michael Aschbacher
Eric D. Bedford
Henri Gillet
Jerry Lawrence Kazdan
Walter D. Neumann
Stephen Wainger

Additional candidates may be nominated by petition, deadline for which is July 6.

Editorial Boards Committee

Two members of the Editorial Boards Committee are to be elected in the fall of 1990 to serve for a term of three years. Continuing members are:

Linda Keen
Carlos Kenig
Barry Simon
Daniel Zelinsky

President William Browder has named four candidates for the other two places. They are:

Jon F. Carlson
Richard J. Milgram
Stephen S. Shatz
Nolan R. Wallach

Additional candidates may be nominated by petition, deadline for which is July 6.

Robert M. Fossum
Secretary
Urbana, Illinois

Columbus Meetings
August 8–11, 1990

Preliminary Program

The preliminary program for the Columbus Meetings follows. Participants who preregistered by June 6 and who so elected will have their badge and the final program mailed to them before the meetings. All other registrants will receive the final program at the meetings. Participants who have not yet registered should read the information in the April and May/June issues of *Notices* and the April issue of *Focus* for further details. The additional information below is to assist those who will register at the meetings and those preregistrants who elected not to receive their badge and final program by mail.

Registration at the Meetings

Meeting preregistration and registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register, and should be prepared to show their meeting badge, if so requested. Badges are required to obtain discounts at the AMS and MAA Book Sales and to cash a check with the meeting cashier. If a preregistrant should arrive too late in the day to pick up his/her badge, he/she may show the acknowledgement received from the Mathematics Meetings Housing Bureau as proof of registration.

Registration fees: Registration fees may be paid at the meetings in cash, by personal or travelers' check, or by Visa or MasterCard credit card. Canadian checks must be marked for payment in U.S. funds. Although other credit cards are being accepted by hotels for housing payments, only Visa or MasterCard can be accepted for registration. Letters verifying attendance at the meetings can be obtained from the cashier or at the Registration Assistance section of the registration desk.

Participants wishing to attend sessions for one day only may take advantage of a one-day fee which is equal to 55% of the on-site registration fee for either members or nonmembers. These special fees are effective daily August 8 through 11, and are available at the meetings to members and nonmembers only. These one-day fees are not applicable to student, unemployed, or emeritus participants, whose fees for registration at the meetings are listed below.

Joint Mathematics Meetings	
Member of AMS, Canadian Mathematical Society, MAA, ΠΜΕ	$ 93
Emeritus Member of AMS, MAA	$ 32
Nonmember	$141
Student/Unemployed	$ 32
Joint Mathematics Meetings One Day	
Member of AMS, CMS, MAA	$ 51
Nonmember	$ 78
AMS Short Course	
Student/Unemployed	$ 20
Member/Nonmember	$ 50
Emeritus Member of AMS, MAA	$ 20
MAA Minicourses	
(if openings available)	
Minicourses # 1, 2, 3, 5, 6, 8	$ 36
Minicourses #4, 7, 9, 10, 11, 13	$ 60
Minicourse #12	$ 18

There is no extra charge for members of the families of registered participants, except that all professional mathematicians who wish to attend sessions must register independently.

All **full-time** students currently working toward a degree or diploma qualify for the student registration fees, regardless of income.

The unemployed status refers to any person currently unemployed, actively seeking employment, and who is not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

Persons who qualify for emeritus membership in either the Society or the Association may register at the emeritus member rate. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more, and is retired on account of age or on account of long term disability from his or her latest position.

Nonmembers who preregister or register at the meeting and pay the nonmember fee will receive mailings from AMS and MAA, after the meeting is over, containing information about a special membership offer.

An income tax deduction is allowed for education expenses, including registration fees, cost of travel, meals and lodging incurred to (i) maintain or improve skills in one's employment or trade or business or (ii) meet express requirements of an employer or a law imposed as a condition to retention of employment, job status, or rate of compensation. This is true even for education that leads to a degree. However, the Tax Reform Act of 1986 has introduced significant changes to this area. In general, the deduction for meals is limited to 80% of the cost. Unreimbursed employee educational expenses are subject to a 2% of adjusted gross income floor. There are exceptions to these rules; therefore, one should contact one's tax advisor to determine the applicability of these provisions.

Registration Dates, Times, and Locations

AMS Short Course
Outside Conference Theatre, Ohio Union

Monday, August 6	8:30 a.m. to 2:30 p.m.

Joint Mathematics Meetings
[and MAA Minicourses (until filled)]
Main Lounge, Ohio Union

Tuesday, August 7	3:00 p.m. to 7:00 p.m.
Wednesday, August 8 through Friday, August 10	7:30 a.m. to 4:00 p.m.
Saturday, August 11	7:30 a.m. to 1:00 p.m.

Directions to the Joint Mathematics Meetings Registration Desk: The Ohio Union is located at 1739 North High Street. Enter the building at the northeast entrance and take the stairs up to the Lobby. Go left at the newsstand, pass the art gallery on the right. The Main Lounge is on the left where the large stone fireplace is located.

Accommodations

Participants who did not reserve a room during preregistration and would like to reserve a room at one of the hotels listed on page 466 of the April issue of *Notices* and in *Focus* should call the hotels directly. All rooms and rates listed **are based on availability ONLY.**

Those participants who did not arrange for a room on campus but wish to be assigned a room onsite must go to the University Residential Office (URO) located in the ground floor lobby of Drackett Tower. The office is open 24 hours a day, seven days a week. Payments for rooms are due at check-in time and must be made at the URO. Payments at the URO may be made with cash, traveler's checks, personal checks, VISA or MasterCard. No other credit cards can be accepted. Rooms for walk-ins are limited and **are based on availability ONLY.**

Travel

Two major interstate highways make Columbus accessible by car. From the east or west, take Interstate 70; from the north or south, follow Interstate 71. The Outerbelt I-270 encircles the city and intersects both of the interstates. From the north, take the Outerbelt west and exit at 315 South. From the west, south, or east, follow route signs to 315 North. Travelling either north or south on 315, exit at Lane Avenue and travel east for approximately one mile to the Ohio State campus area.

Unless otherwise posted, it is legal to make a right turn on a red light after coming to a complete stop and signaling. It is also legal to make a left turn on a red light if turning from a one-way street onto another one-way street. Again, it is mandatory to come to a full stop and use a turn signal.

Updated driving directions from the Port Columbus Airport to the URO are as follows: Take a left on Steltzer Road. Take ramp onto Route 62. Get off on 5th Avenue West. Take a right on 4th Street North. Follow 4th Street North to 15th Avenue. Turn left to High Street. Turn right to Woodruff (two blocks). Turn left on Woodruff to Curl Drive. Follow Curl Drive to Drakett Tower. Directions to specific residence halls will be provided by the URO.

Preliminary Program of the Sessions

If available, abstracts of papers presented by the AMS-MAA lecturer, AMS Progress in Mathematics Lecturers, AMS invited 50-minute speakers, MAA Hedrick Lecturer, MAA invited speakers, MAA joint invited speakers, and speakers in other MAA sessions will be found in a colored insert in the program given to registrants. Abstracts of papers presented in AMS Special Sessions and AMS Sessions for Contributed Papers will be found in the August issue of *Abstracts of papers presented to the American Mathematical Society*, which will also be provided to registrants at the meeting, upon request. Abstracts for talks other than AMS and MAA are not available.

To maintain the schedule, beginning and ending times of presentations will be strictly enforced.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting. Where a presenter is visiting another institution, the permanent affiliation is given first, followed by the name of the institution being visited.

Monday, August 6

AMS Short Course

9:00 a.m.–5:00 p.m.

9:00 a.m. *What is a game?*
(1) **Richard K. Guy**, University of Calgary

10:45 a.m. *Numbers and games.*
(2) **John H. Conway**, Princeton University

2:00 p.m. *Impartial games.*
(3) **Richard K. Guy**, University of Calgary

3:45 p.m. *More ways of combining games.*
(4) **John H. Conway**, Princeton University

Tuesday, August 7

MAA Board of Governors

8:30 a.m.–4:00 p.m.

AMS Short Course

9:00 a.m.–5:00 p.m.

9:00 a.m. *Introductory overview of mathematical Go endgames.*
(5) **Elwyn R. Berlekamp**, University of California, Berkeley

10:45 a.m. *Games and codes.*
(6) **Vera S. Pless**, University of Illinois, Chicago

2:00 p.m. *Complexity of games.*
(7) **Aviezri S. Fraenkel**, Weizmann Institute of Science, Israel

3:45 p.m. *..., Welter's Game, Sylver Coinage, Dots-and-Boxes,...*
(8) **Richard J. Nowakowski**, Dalhousie University

AMS Council

2:00 p.m.–7:00 p.m.

MAA Section Officers

4:00 p.m.–6:00 p.m.

Joint Policy Board for Mathematics: National Meetings of Department Heads

8:15 p.m.–10:00 p.m.

Curriculum reform–How does a department chair cause it to happen?.

Wednesday, August 8

Opening Ceremonies

8:30 a.m.–9:30 a.m.

MAA Invited Address

9:55 a.m.–10:45 a.m.

(9) *The seventy-fifth anniversary celebration.*
G. Baley Price, University of Kansas

Plaque Ceremony

10:55 a.m.–11:00 a.m.

Wednesday, August 8 (cont'd)

MAA Invited Address

11:10 a.m.–noon

(10) *Was Newton's calculus just a deadend? Maclaurin and the Scottish connection.*
Judith V. Grabiner, Pitzer College, Scotland

MAA Invited Address

1:30 p.m.–2:00 p.m.

(11) *Mathematics and computation: Proliferation and fragmentation.*
Wade Ellis, Jr., West Valley College

MAA Invited Address

2:10 p.m.–2:40 p.m.

(12) *Has progress in mathematics slowed down?*
Paul R. Halmos, Santa Clara University

MAA Invited Address

2:50 p.m.–3:20 p.m.

(13) *The contribution of mathematics to education.*
Peter J. Hilton, State University of New York, Binghamton

MAA Invited Address

3:30 p.m.–4:00 p.m.

(14) *The last 75 years: Giants of applied mathematics.*
Cathleen S. Morawetz, Courant Institute of Mathematical Sciences, New York University

Mathematical Circus

4:45 p.m.–5:45 p.m.

Thursday, August 9

MAA Special Presentation

8:00 a.m.–8:30 a.m.

(15) *Theorems in bronze and stone.*
Helaman Ferguson, Supercomputing Research Center, Bowie, Maryland

AMS Special Session on Combinatorics, I

8:00 a.m.–11:50 a.m.

8:00 a.m. *Voltage-current duality.*
(16) **Dan Archdeacon**, University of Vermont (859-05-129)

8:30 a.m. *Bounds on the distance-d domination number.*
(17) Preliminary report.
Joan P. Hutchinson, Macalester College (859-05-109)

9:00 a.m. *Subgraphs with crossing number 2.*
(18) **Dan McQuillan** and **R. B. Richter***, Carleton University (859-05-161)

9:30 a.m. *Graphs containing crossing number 2 graphs.*
(19) **Richard Vitray**, Appalachian State University (859-05-168)

10:00 a.m. *Ideal secret sharing schemes and matroids.*
(20) **Ernest F. Brickell*** and **Daniel M. Davenport**, Sandia National Laboratories (859-05-99)

10:30 a.m. *Howell designs with sub-designs.* Preliminary
(21) report.
J. H. Dinitz*, University of Vermont, and **E. R. Lamken**, Institute for Defense Analyses (859-05-149)

11:00 a.m. *Mappings of sets of pairwise orthogonal*
(22) *orthomorphisms.* Preliminary report.
Robert Roth, Emory University (859-05-82)
(Sponsored by Dwijendra K. Ray-Chaudhuri)

11:30 a.m. *Singularity probabilities for random*
(23) *$\{\pm\}$-matrices.*
Jeff Kahn*, **János Komlós** and **Endre Szemerédi**, Rutgers University, New Brunswick (859-05-84)

AMS Special Session on Algebraic Geometry, I

8:00 a.m.–9:50 a.m.

8:00 a.m. *Valuations and convergence of formal functions.*
(24) Preliminary report.
Mark Spivakovsky, Harvard University (859-13-67)

8:30 a.m. *Weak CMC subsets and orderings of fields.*
(25) **Marie A. Vitulli**, University of Oregon (859-13-108)

9:00 a.m. *Jet bundles and curves in Grassmannians.*
(26) **David Perkinson**, Reed College (859-14-120)

9:30 a.m. *Automorphisms of cuspidal K3-like surfaces in low characteristics.*
(27) **Brian Harbourne**, University of Nebraska, Lincoln (859-14-77)

MAA Minicourse #1: Part A

8:00 a.m.–10:00 a.m.

Using metacognitive strategies to improve instruction. **Genevieve Knight**, Coppin State College

MAA Minicourse #2: Part A

8:00 a.m.–10:00 a.m.

Planning, funding, and administering teacher enhancement projects. **T. Christine Stevens**, St. Louis University

MAA CUPM Subcommittee on Symbolic Computer Systems Poster Session

8:00 a.m.–noon

What students learn in the symbolic computing environment.

MAA Session on The Interface Between Mathematics and Operations Research, Part A

8:05 a.m.–noon

8:05 a.m. *Operations research in the shipping industry.*
(28) **Ken Bloom**, Stolt-Nielsen Inc., Greenwich, Connecticut

9:15 a.m. *Operations research at the United States Coast*
(29) *Guard Academy.*
Ted Lindstrom* and **Ernest J. Manfred**, United States Coast Guard Academy

9:40 a.m. *Optimization: The world as a system of*
(30) *equations.*
Patrick T. Harker, University of Pennsylvania

10:05 a.m. *An improved counterexample to the rudimentary*
(31) *primal algorithm.*
Robert Haas*, **Harvey M. Salkin** and **Kamlesh Mathur**, Case Western Reserve University

10:30 a.m. *Waiting in line: The mathematics of queuing.*
(32) **Karen J. Schroeder**, Bentley College

11:00 a.m. *Modeling and analysis of telecommunications*
(33) *systems.*
Shlomo Halfin, Bell Communications Research Inc., Morristown, New Jersey

AMS Special Session on Dynamics of Biological Systems, I

8:30 a.m.–11:50 a.m.

8:30 a.m. *The transition from bursting to continuous*
(34) *spiking in a model for excitable membranes.*
David Terman, Ohio State University, Columbus (859-92-85)

9:00 a.m. *An "averaged" model for parabolic bursting*
(35) *oscillations.*
John Rinzel*, National Institute of Health, **Humberto Carrillo-Calvet**, Universidad Nacional Autonoma de Mexico, and **Steven M. Baer**, Arizona State University (859-92-56)

9:30 a.m. *A geometric description of echo.*
(36) **G. Bard Ermentrout***, University of Pittsburgh, Pittsburgh, and **John Rinzel**, National Institute of Health (859-92-92)

10:00 a.m. *Travelling wave solutions for a bistable*
(37) *evolutionary ecology model.*
Roger Lui, Worcester Polytechnic Institute (859-35-71)

10:30 a.m. *Existence of travelling wave solutions for*
(38) *reaction diffusion systems.*
Konstantin M. Mischaikow, Georgia Institute of Technology (859-35-144)

11:00 a.m. *The existence of infinitely many traveling front*
(39) *and back waves in the FitzHugh-Nagumo equations.*
Bo Deng, University of Nebraska, Lincoln (859-35-105)

11:30 a.m. Discussion

MAA-AAAS Invited Address

8:50 a.m.–9:40 a.m.

(40) *Lost and found mathematics.*
Richard A. Askey, University of Wisconsin, Madison

MAA CUPM Subcommittee on Quantitative Literacy Requirements Panel Discussion

8:50 a.m.–9:40 a.m.

Quantitative literacy.

AMS Special Session on Ring Theory, I

9:00 a.m.–11:50 a.m.

9:00 a.m. *The κ-product of slender modules.* Preliminary
(41) report.
John Dauns* and **Laszlo Fuchs**, Tulane University (859-16-57)

Thursday, August 9 (cont'd)

9:30 a.m. *Finitely generated non-cosmall modules.*
(42) Preliminary report.
Stanley S. Page, University of British Columbia (859-16-72)

10:00 a.m. Intermission

11:00 a.m. *Permutation identity rings.*
(43) **Gary F. Birkenmeier*** and **Henry Heatherly**, University of Southwestern Louisiana (859-16-26)

11:30 a.m. *Distributive modules which are cyclic.*
(44) **Vahap Erdogdu**, Middle East Technical University, Turkey (859-13-08) (Sponsored by Hursit M. Onsiper)

AMS Special Session on Group Theory, I

9:00 a.m.–11:50 a.m.

9:00 a.m. *Isomorphy problem of integral group rings.*
(45) **Hans J. Zassenhaus**, Ohio State University, Columbus (859-20-45)

9:30 a.m. *A conjecture on character degrees.* Preliminary
(46) report.
Michael J. J. Barry, Allegheny College (859-20-22)

10:00 a.m. *k-characters and the group determinant.*
(47) Preliminary report.
Kenneth W. Johnson, Pennsylvania State University, Ogontz and Iowa State University (859-20-13)

10:30 a.m. *Infinite Frobenius groups.*
(48) **Michael J. Collins**, Mathematical Institute, England (859-20-36) (Sponsored by Ronald M. Solomon)

11:00 a.m. *Powers of varieties and faithful representations*
(49) *of groups.* Preliminary report.
Samuel M. Vovsi, Rutgers University, New Brunswick (859-20-17)

11:30 a.m. *The integral group ring problem.*
(50) **Leonard L. Scott, Jr.**, University of Virginia (859-20-37)

MAA Student Chapter Panel Discussion

9:00 a.m.–10:30 a.m.

AWM Panel Discussion

9:00 a.m.–10:00 a.m.

Enrichment programs in urban public schools.

AMS-MAA Invited Address

9:55 a.m.–10:45 a.m.

(51) *Algebra as a means of understanding mathematics.*
Saunders Mac Lane, University of Chicago

AWM Membership Meeting & Prize Session

10:00 a.m.–10:45 a.m.

MAA Minicourse #3: Part A

10:15 a.m.–12:15 p.m.

A seminar on women in mathematics. **Miriam P. Cooney csc**, St. Mary's College

MAA Minicourse #4: Part A

10:15 a.m.–12:15 p.m.

A calculus laboratory using Mathematica. **Michael Barry**, **Benjamin Haytock** and **Richard McDermot**, Allegheny College

MAA Minicourse #5: Part A

10:15 a.m.–12:15 p.m.

Using history in teaching calculus. **V. Frederick Rickey**, United States Military Academy

MAA-NCTM Invited Address

11:00 a.m.–11:50 a.m.

(52) *Mathematics education-yesterday, today, and tomorrow.*
John A. Dossey, Illinois State University

National Science Foundation

noon–1:00 p.m.

MAA Earle Raymond Hedrick Lectures: Lecture I

1:15 p.m.–2:15 p.m.

(53) *Spirals from Theodorus of Cyrene to meta-chaos. Spirals old and new.*
Philip J. Davis, Brown University

MAA-PME Invited Address

2:30 p.m.–3:20 p.m.

(54) *Problems for all seasons.*
Ivan Niven, University of Oregon

MAA Minicourse #1: Part B

2:30 p.m.–4:30 p.m.

Using metacognitive strategies to improve instruction.
Genevieve Knight, Coppin State College

MAA Minicourse #2: Part B

2:30 p.m.–4:30 p.m.

Planning, funding, and administering teacher enhancement projects. **T. Christine Stevens**, St. Louis University

MAA Session on Toward Equity and Excellence: Efforts to Increase the Number of Minorities and Women in the Profession

2:30 p.m.–5:20 p.m.

2:30 p.m. (55) *MathConn 89 and MathConn 90: Two successful mathematics awareness days for seventh and eighth grade girls and their teachers.*
Regina Baron Brunner, Cedar Crest College, Pennsylvania

3:00 p.m. (56) *Encouraging women and older students in mathematics: A math anxiety reduction program.*
Antonella Cupillari, Pennsylvania State University, Erie-Behrend College

3:30 p.m. (57) *Multi-cultural factors in mathematics education.*
Barbara S. Rice, Alabama A & M University

4:00 p.m. (58) *NCI summer enrichment program.*
Gloria F. Gilmer, Math-Tech Inc., Milwaukee, Wisconsin

4:30 p.m. (59) *The efforts of a few can help the many.*
Sherrie J. Nicol, University of Wisconsin, Platteville

5:00 p.m. (60) *A family of equity programs.*
Claudia L. Pinter-Lucke, California Polytechnic State University

MAA Session on The Interface Between Mathematics and Operations Research, Part B

2:30 p.m.–5:20 p.m.

2:30 p.m. (61) *Modeling performance in emergency vehicle systems: A link between mathematics and operations research.*
Jeff Goldberg, University of Arizona

3:40 p.m. (62) *Using synergism to generate new classroom applications of mathematics.*
Miguel Paredes, University of Texas-Pan American

4:05 p.m. (63) *What mathematics teaches the simulationist, and vice versa.*
Diane Driscoll Schwartz, Ithaca College

4:30 p.m. (64) *Four counterexamples to heuristic algorithms for the traveling salesman problem.*
Robert Haas, **Harvey M. Salkin*** and **Kamlesh Mathur**, Case Western Reserve University

5:00 p.m. Movie: Operations research + you = an exciting career.

MAA CUPM Subcommittee on Symbolic Computer Systems Panel Discussion

2:30 p.m.–4:00 p.m.

The pedagogical impact of computer algebra systems on college mathematics curricula.

PME Contributed Paper Session

3:30 p.m.–5:30 p.m.

AMS Progress in Mathematics Lecture

3:35 p.m.–5:05 p.m.

(65) *Viscosity solutions of partial differential equations.*
Michael G. Crandall, University of California, Santa Barbara (859-35-169)

MAA Special Lecture

4:30 p.m.–5:20 p.m.

(66) *The art of mental calculation.*
Arthur T. Benjamin, Harvey Mudd College

Thursday, August 9 (cont'd)

MAA CUPM Subcommittee on Symbolic Computer Systems Special Presentation

4:30 p.m.–5:20 p.m.

Symbolic computing in undergraduate mathematics: Symbols, pictures, numbers, and insights.

MAA Minicourse #3: Part B

4:45 p.m.–6:45 p.m.

A seminar on women in mathematics. **Miriam P. Cooney csc**, Saint Mary's College

MAA Minicourse #4: Part B

4:45 p.m.–6:45 p.m.

A calculus laboratory using Mathematica. **Michael Barry**, **Benjamin Haytock** and **Richard McDermot**, Allegheny College

MAA Minicourse #5: Part B

4:45 p.m.–6:45 p.m.

Using history in teaching calculus. **V. Frederick Rickey**, United States Military Academy

AMS-MAA-MSEB Evening of Dialogue

7:30 p.m.–9:00 p.m.

Mathematics education.

PME J. Sutherland Frame Lecture

8:30 p.m.–9:30 p.m.

(67) *Combinatorics and computers: Coping with finiteness.*
Ronald L. Graham, AT&T Bell Laboratories, Murray Hill, New Jersey

Friday, August 10

AMS Special Session on Combinatorial Games

8:00 a.m.–10:50 a.m.

8:00 a.m. (68) *Dots and boxes.*
R. J. Nowakowski, Dalhousie University (859-05-136) (Sponsored by Richard K. Guy)

8:30 a.m. (69) *On the cookie game.*
James Propp and **Daniel Ullman***, George Washington University (859-05-137)

9:00 a.m. (70) *Nimdi games.*
U. Blass, **A. S. Fraenkel*** and **M. Lorberbom**, Weizmann Institute of Science, Israel (859-05-73)

9:30 a.m. (71) *Invading corridors of territory in Go.*
Elwyn Berlekamp and **David Wolfe***, University of California, Berkeley (859-90-145)

10:00 a.m. (72) *Classical partisan theory extended to loopy games.*
Elwyn Berlekamp, University of California, Berkeley (859-05-138)

10:30 a.m. (73) *Mathematical Kayles.*
William L. Sibert, Stanford, Connecticut, and **John H. Conway***, Princeton University (859-90-122) (Sponsored by Richard K. Guy)

AMS Special Session on Group Theory, II

8:00 a.m.–10:50 a.m.

8:00 a.m. (74) *Strongly p-embedded subgroups of finite simple groups.*
Daniel Gorenstein*, **Richard Lyons**, Rutgers University, New Brunswick, and **Ronald Solomon**, Ohio State University, Columbus (859-20-39)

8:30 a.m. (75) *The maximal subgroups of the Chevalley groups of type $F_4(F)$, char(F)#2.3.*
Kay Magaard, California Institute of Technology (859-20-16)

9:00 a.m. (76) *On the influence of maximal subgroups on the structure of a finite group: Some new results.*
Prabir Bhattacharya*, University of Nebraska, Lincoln, and **N. P. Mukherjee**, Jawaharlal Nehru University, India (859-20-18)

9:30 a.m. (77) *The Schur index of projective characters of symmetric and alternating groups.*
Alexandre Turull, University of Miami (859-20-15)

10:00 a.m. (78) *The representation theory of fully group-graded algebras.*
Paul Boisen, University of Chicago (859-20-69)

10:30 a.m. (79) *On a combinatorial problem associated with the odd order theorem.*
George Glauberman*, University of Chicago, and **Simon P. Norton**, University of Cambridge, England (859-20-33)

AMS Session on Graph Theory and Combinatorics

8:00 a.m.–10:10 a.m.

8:00 a.m. (80) *The multi-intersection number of a graph.*
Frank Harary, New Mexico State University, Las Cruces (859-05-59)

8:15 a.m. (81) *A problem of degrees in graphs.*
Lisa Hansen and **Michelle Schultz***, Western Michigan University (859-05-133)

8:30 a.m. (82) *Subgraph distance in graphs.*
Gary Chartrand*, Western Michigan University, **Garry Johns**, Saginaw Valley State University, **Karen S. Novotny**, Grand Valley State University, and **Ortrud R. Oellermann**, University of Natal, Republic of South Africa (859-05-131)

8:45 a.m. (83) *Clique representations of chordal-like graphs.* Preliminary report.
Charles Carraher* and **Terry McKee**, Wright State University (859-05-75)

9:00 a.m. (84) *Planarity of n-subgraph distance graphs.*
Gary Chartrand, Héctor Hevia, Elzbieta B. Jarrett*, Western Michigan University, and **Donald W. Vanderjagt**, Grand Valley State University (859-05-132)

9:15 a.m. (85) *A different algorithm for the detection of 3-manifolds.*
John Emert*, Ball State University, and **Lawrence Husch**, University of Tennessee, Knoxville (859-05-125)

9:30 a.m. (86) *Routings for involutions of a hypercube.*
Alan P. Sprague*, University of Alabama, Birmingham, and **Hisao Tamaki**, Ibaraki University, Japan (859-05-97)

9:45 a.m. (87) *Smallest tournaments with given abelian automorphism group.*
William C. Arlinghaus, Lawrence Technical University (859-05-117)

10:00 a.m. (88) *A combinatorial approach to temporal reasoning.*
Alexander Belfer, Bar-Ilan University, Israel, and **Martin Charles Golumbic***, IBM Israel Scientific Center, Israel (859-05-34)

MAA Session

8:00 a.m.–9:30 a.m.

Modeling.

AMS Session on Geometry, Topology and Infinite Combinatorics

8:20 a.m.–10:45 a.m.

8:20 a.m. (89) *The p-torsion of the Farrell-Tate cohomology of the mapping class group* $\Gamma_{(p-1)/2}$. Preliminary report.
Yining Xia, Ohio State University, Columbus (859-55-158)

8:35 a.m. (90) *Minimal surfaces satisfying the spherical Ricci condition.*
Gene Douglas Johnson, Franklin & Marshall College (859-53-155)

8:50 a.m. (91) *On a conjecture of Nitsche.*
Gregory D. Crow, John Carroll University (859-53-52)

9:05 a.m. (92) *Consequences of the lattice pentagon property.*
Stanley Rabinowitz, Westford, Massachusetts (859-52-142)

9:20 a.m. (93) *Euclidean hypersurfaces with reflection properties.* Preliminary report.
Daniel Drucker, Wayne State University (859-53-106)

9:35 a.m. (94) *Lattice realcompactifications.* Preliminary report.
James Camacho, Jr., Jersey City State College (859-28-143)

9:50 a.m. (95) *A note on minimal cover refinable spaces.* Preliminary report.
Gangadhar Hiremath, Talladega College (859-54-95)

10:05 a.m. (96) *Connectedness of self-similar sets.* Preliminary report.
Gary Lewellen, Appalachian State Univesity (859-54-51)

10:20 a.m. (97) *Non-homeomorphic disjoint spaces whose union is* ω^*.
W. W. Comfort*, Wesleyan University, and **Akio Kato**, National Defense Academy, Japan (859-54-111)

10:35 a.m. (98) *Measurable cardinals and category bases.*
Andrzej Szymanski, Slippery Rock University of Pennsylvania (859-04-49)

AMS Special Session on Dynamics of Biological Systems, II

8:30 a.m.–10:50 a.m.

8:30 a.m. (99) *Resonance and phase-locking in excitable systems.*
Hans G. Othmer, University of Utah (859-92-153)

Friday, August 10 (cont'd)

9:00 a.m. (100) *Computer simulations of excitation in an anatomically based model of the ventricular conduction system.*
Andrew E. Pollard, Nora Eccles Harrison Cardiovascular Research and Training Insitute, University of Utah (859-92-86) (Sponsored by David Terman)

9:30 a.m. (101) *A dynamical systems analysis of a population genetics model of learning.*
Steven R. Dunbar, University of Nebraska, Lincoln (859-92-123)

10:00 a.m. (102) *Applications of the stability index.*
Robert Gardner, University of Massachusetts, Amherst (859-35-68)

10:30 a.m. (103) *Travelling waves in fast/slow systems.* Preliminary report.
Christopher Jones*, University of Maryland, College Park, and **Nancy Kopell**, Boston University (859-34-128)

MAA Minicourse #6: Part A

8:30 a.m.–10:30 a.m.

Writing to learn mathematics. **Agnes Azzolino**, Middlesex County College

MAA Minicourse #7: Part A

8:30 a.m.–10:30 a.m.

Exploring mathematics with the NeXT computer. **Charles G. Fleming** and **Judy D. Halchin**, Eastern Illinois University

MAA Minicourse #8: Part A

8:30 a.m.–10:30 a.m.

A mathematician's introduction to the HP-48SX scientific expandable calculator for first-time users. **Don LaTorre** and **John Kenelly**, Clemson University

MAA Minicourse #9: Part A

8:30 a.m.–10:30 a.m.

Starting, funding and sustaining mathematics laboratories. **James E. White**, Kenyon College

MAA Session on Liberal Arts Mathematics Courses, Part A

8:30 a.m.–10:55 a.m.

8:30 a.m. (104) *Using elementary modeling with graphs and networks as the basis of a liberal arts mathematics course.*
Helen Christensen, Loyola College, Maryland

8:45 a.m. (105) *A course in graph modeling for liberal arts students.*
Anne E. Brown, Saint Mary's College, Indiana

9:00 a.m. (106) *A course in the theory of voting.*
Roger B. Nelsen, Lewis & Clark College

9:15 a.m. (107) *An accessible combinatorics module for liberal arts students.*
Emelie Kenney, Siena College, New York

9:30 a.m. (108) *Customized student papers in liberal arts mathematics.*
Robert Bumcrot, Hofstra University

9:45 a.m. (109) *Probability and calculus in a liberal arts mathematics course.*
Kay Gura* and **Giovanni Viglino**, Ramapo College of New Jersey

10:00 a.m. (110) *Using cooperative learning with oral protocols in mathematics for liberal arts students.*
G. Joseph Wimbish, Huntingdon College and University of Alabama

10:15 a.m. (111) *Optimization without calculus.*
James W. Petticrew, University of Texas-Pan American

10:30 a.m. (112) *How mathematics grows.*
Jerry D. Taylor, Campbell University

10:45 a.m. (113) *A tour in knot theory.*
Stefanos Gialamas, Columbia College, Chicago

AMS Invited Address

8:50 a.m.–9:40 a.m.

(114) *The role of microlocal analysis in PDE.*
Michael E. Taylor, University of North Carolina, Chapel Hill (859-35-100)

MAA Committee on the Teaching of Undergraduate Mathematics Panel Discussion

9:00 a.m.–10:50 a.m.

Research in learning undergraduate mathematics.

MAA Committee on Computers in Mathematics Education Panel Discussion

9:00 a.m.–10:50 a.m.

Visualization project.

PME Contributed Paper Session

9:15 a.m.–10:50 a.m.

AMS Invited Address

9:55 a.m.–10:45 a.m.

(115) *Statistical mechanics of Coulomb systems.*
Joseph G. Conlon, University of Michigan, Ann Arbor (859-82-101)

AMS Prize Session and Business Meeting

11:05 a.m.–noon 0

National Science Foundation

noon–1:00 p.m.

PME Council

12:15 p.m.–1:15 p.m.

MAA Earle Raymond Hedrick Lectures: Lecture II

1:15 p.m.–2:15 p.m.

(116) *Spirals from Theodorus of Cyrene to meta-chaos. Lessons from Euler.*
Philip J. Davis, Brown University

MAA-CMS Invited Address

2:30 p.m.–3:20 p.m.

(117) *Prime number records.*
Paulo Ribenboim, Queen's University

AMS Special Session on Combinatorics, II

2:30 p.m.–4:50 p.m.

2:30 p.m. (118) *Graphs, games and structure theorems.*
Neil Robertson, Ohio State University, Columbus, **P. D. Seymour**, Bellcore, Morristown, New Jersey, and **Robin Thomas***, Georgia Institute of Technology (859-05-165)

3:00 p.m. (119) *Supeulerian and collapsible graphs.*
Paul A. Catlin, Wayne State University (859-05-151) (Sponsored by Jingyal Pak)

3:30 p.m. (120) *A characterization in $\mathbf{Z}^n$ of unit-distance graphs in $\mathbf{R}^n$.*
Kiran B. Chilakamarri, Ohio State University, Columbus (859-05-146)

4:00 p.m. (121) *Loop transversals to linear codes.* Preliminary report.
Jonathan D. H. Smith, Iowa State University (859-05-23) (Sponsored by Dwijendra K. Ray-Chaudhuri)

4:30 p.m. (122) *Large sets of disjoint t-designs.*
Yeow Meng Chee, **Charles J. Colbourn**, **Steven C. Furino**, University of Waterloo, and **Donald L. Kreher***, University of Wyoming (859-05-80)

AMS Special Session on Algebraic Geometry, II

2:30 p.m.–4:20 p.m.

2:30 p.m. (123) *Canonical resolution of hypersurface singularities of characteristic p.*
T. T. Moh, Purdue University, West Lafayette (859-13-141)

3:00 p.m. (124) *Whose theorem is this?*
Bruce Reznick, University of Illinois, Urbana-Champaign (859-14-98)

3:30 p.m. (125) *Topology of Milnor fibers of minimally elliptic singularities.* Preliminary report.
Lee J. McEwan, Ohio State University, Mansfield (859-14-130) (Sponsored by Gary P. Kennedy)

4:00 p.m. (126) *Semple's bundles of higher-order data.* Preliminary report.
Susan Jane Colley and **Gary Kennedy***, Oberlin College (859-14-102)

AMS Special Session on Ring Theory, II

2:30 p.m.–4:50 p.m.

2:30 p.m. (127) *Primitive ideals in enveloping algebras of classical simple Lie superalgebras.*
Ian M. Musson, University of Wisconsin, Milwaukee (859-16-58)

Friday, August 10 (cont'd)

3:00 p.m. (128) *The algebraic structure of linearly recursive sequences under Hadamard product.* **Richard G. Larson**, University of Illinois, Chicago, and **Earl J. Taft***, Rutgers University, New Brunswick (859-16-05)

3:30 p.m. (129) *Classical localization in a Morita context.* **Philippe Loustaunau** and **Jay Shapiro***, George Mason University (859-16-61)

4:00 p.m. (130) *Value groups and distributivity.* **Hans H. Brungs***, University of Alberta, and **Joachim Gräter**, Technische Universität, Germany (859-16-63)

4:30 p.m. (131) *Idempotents in matrix rings.* Preliminary report. **Christopher Barnett**, Imperial College of Science & Technology, England, and **Victor Camillo***, University of Iowa (859-16-28)

MAA Minicourse #6: Part B

2:30 p.m.–4:30 p.m.

Writing to learn mathematics. **Agnes Azzolino**, Middlesex County College

MAA Minicourse #7: Part B

2:30 p.m.–4:30 p.m.

Exploring mathematics with the NeXT computer. **Charles G. Fleming** and **Judy D. Halchin**, Eastern Illinois University

MAA Minicourse #9: Part B

2:30 p.m.–4:30 p.m.

Starting, funding and sustaining mathematics laboratories. **James E. White**, Kenyon College

AMS Session on Group Theory

2:30 p.m.–4:25 p.m.

2:30 p.m. (132) *On automatic groups.* **Kazem Mahdavi**, State University of New York, College at Potsdam (859-20-42)

2:45 p.m. (133) *On the integral cohomology of split metacyclic groups.* Preliminary report. **Dean Larson**, Gonzaga University (859-20-127)

3:00 p.m. (134) *Finite groups having chain difference one.* Preliminary report. **Ben Brewster**, State University of New York, Binghamton, **Michael B. Ward***, Bucknell University, and **Irene Zimmermann**, Freiburg, Germany (859-20-74)

3:15 p.m. (135) *Metabelian groups with all cyclic subgroups subnormal of bounded defect.* Preliminary report. **David J. Garrison**, IBM Corporation, Owego, New York (859-20-66)

3:30 p.m. (136) *Thin bases for finite groups.* **Xing-De Jia**, Graduate School and University Center, City University of New York (859-20-88)

3:45 p.m. (137) *Some characters of twisted wreath products.* **George F. Yeh**, State University of New York, Binghamton (859-20-103)

4:00 p.m. (138) *On exponential groups.* **Patrick B. Chen***, John Carroll University, and **Ta-Sun Wu**, Case Western Reserve University (859-22-152)

4:15 p.m. (139) *A special class of finite p-groups.* Preliminary report. **Matthew P. Fisher**, State University of New York, Binghamton (859-20-166)

MAA Session on Liberal Arts Mathematics Courses, Part B

2:30 p.m.–4:40 p.m.

2:30 p.m. (140) *Mathematical tools for critical thinking: A liberal arts mathematics course.* **Curtis McKnight**, University of Oklahoma

2:45 p.m. (141) *Mathematics and the modern world: Core curriculum mathematics at a large public university.* **Richard Mercer**, Wright State University

3:00 p.m. (142) *Developing students' mathematical power in liberal arts mathematics courses.* **Roger H. Marty**, Cleveland State University

3:15 p.m. (143) *Mathematics for sensible living: Making connections with the adult world.* **Constance M. Elson**, Ithaca College

3:30 p.m. (144) *"What is mathematics?" Is this the question for liberal arts students?* **Bruce Williamson**, University of Wisconsin, River Falls

3:45 p.m. (145) *Reading and writing in a mathematical ideas course.* **Richard Alan Gillman**, Valparaiso University

4:00 p.m. (146) *Can students in core requirement courses do mathematics on a creative level?* **Rhonda L. Hatcher**, Saint Olaf College

4:15 p.m. (147) *A survey approach to liberal arts mathematics.* **Dan Kalman**, Rancho Palos Verdes, California

4:30 p.m. (148) *Symmetry: Unifying abstraction, intuition and applications in a liberal arts mathematics course.*
Thomas Q. Sibley, Saint John's University, Minnesota

PME Contributed Paper Session

2:30 p.m.–4:50 p.m.

MAA-SIAM Invited Address

3:35 p.m.–4:25 p.m.

(149) *Interior point methods for linear programming: An overview.*
Richard A. Tapia, Rice University

MAA Open Discussion on Consultants

3:50 p.m.–4:50 p.m.

MAA Prize Session and Business Meeting

5:05 p.m.–6:00 p.m.

AMS Committee on Science Policy Panel Discussion

8:00 p.m.–10:00 p.m.

Responsibilities of mathematicians in the implementation of the DAVID II Report.

Saturday, August 11

AMS Special Session on Combinatorics, III

8:00 a.m.–11:50 a.m.

8:00 a.m. (150) *Delsarte's inequalities and t-designs.*
Richard M. Wilson, California Institute of Technology (859-05-154) (Sponsored by Dwijendra K. Ray-Chaudhuri)

8:30 a.m. (151) *Association schemes on triples and a ternary algebra.*
Dale M. Mesner and **Prabir Bhattacharya***, University of Nebraska, Lincoln (859-05-19)

9:00 a.m. (152) *Cycle ideals and tactical partitions of distance-regular graphs.*
Aaron D. Meyerowitz, Florida Atlantic University (859-05-119)

9:30 a.m. (153) *A large set of designs on vector spaces.*
D. K. Ray-Chaudhuri and **Erin J. Schram***, Ohio State University, Columbus (859-05-79)

10:00 a.m. (154) *Structure theory of planar graphs embedded on nonplanar surfaces.* Preliminary report.
Bojan Mohar, University of Ljubljana, Yugoslavia, **Neil Robertson***, Ohio State University, Columbus, and **Richard Vitray**, Appalachian State University (859-05-147)

10:30 a.m. (155) *Leafless trees in countable graphs.* Preliminary report.
Bogdan Oporowski, Louisiana State University, Baton Rouge (859-05-162)

11:00 a.m. (156) *Incidence matrices in geometric lattices.*
Joseph P. S. Kung, University of North Texas (859-05-35)

11:30 a.m. (157) *Strong Tutte functions of matroids and graphs.*
Thomas Zaslavsky, State University of New York, Binghamton (859-05-29)

AMS Special Session on Ring Theory, III

8:00 a.m.–11:50 a.m.

8:00 a.m. (158) *The enumeration of finite chain rings.*
Yousif Al-Khamees, King Saud University, Saudi Arabia (859-16-96)

8:30 a.m. (159) *Injectivity, P-injectivity and V-rings.*
Roger Yue Chi Ming, University of Paris VII, France (859-16-60) (Sponsored by S. K. Jain)

9:00 a.m. (160) *CS-modules with chain conditions.*
V. Camillo, University of Iowa, and **M. F. Yousif***, Ohio State University, Lima (859-16-110)

9:30 a.m. (161) *Orders in blocked triangular matrix rings.*
Ming-Sun Li, Oberlin College, and **Julius Zelmanowitz***, University of California, Santa Barbara (859-16-104)

10:00 a.m. (162) *Nonsingular retractable modules and their endomorphism rings.*
Soumaya Khuri, East Carolina University (859-16-27)

10:30 a.m. (163) *On the weak-injectivity of rings.* Preliminary report.
Abdullah Al-Huzali, **S. K. Jain** and **S. R. Lopez-Permouth***, Ohio University, Athens (859-16-87)

11:00 a.m. (164) *Class decomposition of modules.*
Saad Mohamed, Kuwait University, Kuwait (859-16-44)

11:30 a.m. (165) *Modules with chain conditions on superfluous submodules.*
Ibrahim AL-Khazzi and **Patrick F. Smith***, University of Glasgow, Scotland (859-16-64)

Saturday, August 11 (cont'd)

AMS Special Session on Group Theory, III

8:00 a.m.–11:50 a.m.

8:00 a.m. (166) *A numerical approach to rewriteability in finite groups.* **Judy L. Leavitt**, University of Illinois, Urbana-Champaign, **Gary J. Sherman***, Rose-Hulman Institute of Technology, and **Mark E. Walker**, University of Illinois, Urbana-Champaign (859-20-83)

8:30 a.m. (167) *A special class of finite p-groups.* Preliminary report. **Wolfgang P. Kappe**, State University of New York, Binghamton (859-20-32)

9:00 a.m. (168) *Property ν in groups.* Preliminary report. **James C. Beidleman**, University of Kentucky (859-20-10)

9:30 a.m. (169) *Intersections of subgroup functors.* Preliminary report. **Ben Brewster**, State University of New York, Binghamton (859-20-24)

10:00 a.m. (170) *On exact power margin groups.* Preliminary report. **Luise-Charlotte Kappe**, State University of New York, Binghamton (859-20-31)

10:30 a.m. (171) *Levi-properties generated by varieties.* Preliminary report. **Robert Fitzgerald Morse**, IBM Corporation, Owega,New York (859-20-38)

11:00 a.m. (172) *Non-normal projectivities of metacyclic p-groups.* **Charles Holmes**, Miami University (859-20-41)

11:30 a.m. (173) *On the structure of dual-standard subgroups.* **Stewart Stonehewer**, Warwick University, England, and **Giovanni Zacher***, Universitá di Padova, Italy (859-20-40)

MAA Minicourse #10: Part A

8:00 a.m.–10:00 a.m.

CAS laboratory projects for calculus. **Carl Leinbach**, Gettysburg College

MAA Minicourse #6: Part C

8:00 a.m.–10:00 a.m.

Writing to learn mathematics. **Agnes Azzolino**, Middlesex County College

AMS Session on Algebraic Number Theory and Multiplicative Structures

8:00 a.m.–10:55 a.m.

8:00 a.m. (174) *A note on fundamental properties of recurring series.* **Joseph Arkin**, **David C. Arney**, **Frank R. Giordano** and **Rickey A. Kolb***, United States Military Academy (859-11-54)

8:15 a.m. (175) *Explicit construction of certain metacyclic extensions.* **Stanley Gurak**, University of San Diego (859-11-113) (Sponsored by Lynne B. Small)

8:30 a.m. (176) *Small two variable exponential diophantine equations.* Preliminary report. **Robert Styer**, Villanova University (859-11-163)

8:45 a.m. (177) *Narcissistic loops.* **John F. Lamb, Jr.**, East Texas State University (859-11-04)

9:00 a.m. (178) *Divisor functions and subgroups of dihedral groups.* **David W. Jensen*** and **Michael K. Keane**, United States Air Force Academy (859-11-06)

9:15 a.m. (179) *The original manuscript of the generalized Fibonacci numbers combined with the generalized Pascal triangle.* **Joseph Arkin***, **David C. Arney** and **Frank R. Giordano**, United States Military Academy (859-11-47)

9:30 a.m. (180) *Supercube* II. **Joseph Arkin**, **David C. Arney*** and **Frank R. Giordano**, United States Military Academy (859-11-48)

9:45 a.m. (181) *The structure of stochastic complements in irreducible stochastic matrices.* **Peter M. Gibson**, University of Alabama, Huntsville (859-15-62)

10:00 a.m. (182) *The eigenvalue problem without determinants.* Preliminary report. **William A. McWorter** and **Leroy F. Meyers***, Ohio State University, Columbus (859-15-118)

10:15 a.m. (183) *The isometries of certain finite dimensional normed spaces.* **Rohan Hemasinha*** and **James R. Weaver**, University of West Florida (859-15-90)

10:30 a.m. (184) *Universal localization of $\tilde{A}_{12}$, twisted pencils of matrices, and indecomposable modules.* Preliminary report. **Mike May, S. J.**, Cambridge, Massachusetts (859-16-121)

10:45 a.m. (185) *Centroids and root systems.* **Duncan J. Melville**, Yale University (859-17-124) (Sponsored by George B. Seligman)

PME Contributed Paper Session

8:00 a.m.–10:45 a.m.

MAA Session on Liberal Arts Mathematics Courses, Part C

8:30 a.m.–10:55 a.m.

8:30 a.m. (186) *A health sciences core curriculum sequence in mathematics.*
Henry C. Foehl, Philadelphia College of Pharmacy and Science, Pennsylvania

8:45 a.m. (187) *Mathematics for honors students in liberal arts and business.*
Satish C. Bhatnager* and **Leonard Zane**, University of Nevada, Las Vegas

9:00 a.m. (188) *Creating new avenues for liberal arts students.*
Dave Wells* and **Lynn Schmitt**, Pennsylvania State University, New Kensington Campus

9:15 a.m. (189) *Other people's math: What every student should know.*
Lucy L. Deephouse* and **Timothy V. Craine**, Trinity College, Connecticut

9:30 a.m. (190) *An attempt to teach mathematics.*
Kathleen A. Taylor, Duquesne University

9:45 a.m. (191) *Math and math anxious.*
Margaret Herzog, Pacific Lutheran University

10:00 a.m. (192) *Contemporary mathematics and its utilitarian value.*
Ronald J. Czochor, Glassboro State College, New Jersey

10:15 a.m. (193) *Who are the liberal arts students and what math is "practical" for them?*
Carole A. Bauer, Triton College, Illinois

10:30 a.m. (194) *Who is our customer and what does she need to know?*
JoAnne S. Growney, Bloomsburg University

10:45 a.m. (195) *What does all this have to do with mathematics?*
Barry Brunson, Western Kentucky University

MAA-ACM Invited Address

8:50 a.m.–9:40 a.m.

(196) *On the computational complexity of doing mathematics.*
Juris Hartmanis, Cornell University

AMS Special Session on Algebraic Geometry, III

9:00 a.m.–11:50 a.m.

9:00 a.m. (197) *Mordell-Weil groups of extremal K3 surfaces.*
Rick Miranda, Colorado State University (859-14-126)

9:30 a.m. (198) *Determinantal transversality criteria.*
Robert Speiser, Brigham Young University (859-14-55)

10:00 a.m. (199) *Rationally triangulable automorphisms.*
James K. Deveney and **David R. Finston***, Virginia Commonwealth University (859-13-30)

10:30 a.m. (200) *The Gauss map of a generic genus 4 theta divisor.* Preliminary report.
Robert Varley*, **Malcolm Adams**, **Clint McCrory** and **Theodore Shifrin**, University of Georgia (859-14-139)

11:00 a.m. (201) *Minimal models of elliptic threefolds.*
Antonella Grassi, Duke University (859-14-94)

11:30 a.m. (202) *Infinitesimal propagation of line bundles among curves on algebraic varieties.* Preliminary report.
Yun-Gang Ye, Duke University (859-14-164)

MAA CUPM Subcommittee on Calculus Reform and the First Two Years Panel Discussion

9:00 a.m.–10:20 a.m.

MAA-NAM Invited Address

9:55 a.m.–10:45 a.m.

(203) *Intriguing problems about zeros in complex analysis.*
Carl Lindell Prather, Virginia Polytechnic Institute and State University

MAA Minicourse #11: Part A

10:15 a.m.–12:15 p.m.

Producing mathematics courseware with Mathematica: Calculus and Mathematica. **Don Brown**, **Horacio Porta** and **Jerry Uhl**, University of Illinois, Urbana

MAA Minicourse #12

10:15 a.m.–12:15 p.m.

Exploring statistics and discrete mathematics topics using inexpensive graphing calculators. **Franklin Demana** and **Bert K. Waits**, Ohio State University

MAA Minicourse #13: Part A

10:15 a.m.–12:15 p.m.

Spreadsheet based mathematical topics for nonmathematics majors. **V. S. Ramamurti**, University of North Florida

Saturday, August 11 (cont'd)

MAA-PME Undergraduate Student Paper Session

10:30 a.m.–12:20 p.m.

MAA Science Policy Committee Panel Discussion

10:30 a.m.–noon

State mathematics coalitions.

MAA-AWM Invited Address

11:00 a.m.–11:50 a.m.

(204) *The uses of set theory.*
Judith Roitman, University of Kansas

National Science Foundation

noon–1:00 p.m.

AMS Special Session on Combinatorics, IV

1:00 p.m.–3:20 p.m.

1:00 p.m. (205) *Large sets of disjoint combinatorial structures.* Preliminary report.
Luc Teirlinck, Auburn University, Auburn (859-05-81)

1:30 p.m. (206) *Invariant linear forms and regularity in codes and designs.* Preliminary report.
A. R. Calderbank, AT&T Bell Laboratories, Murray Hill, New Jersey (859-05-70)

2:00 p.m. (207) *Designs from maximal arcs and difference sets.* Preliminary report.
J. F. Dillon, National Security Agency (859-05-150)

2:30 p.m. (208) *The subconstituent algebra of a graph of thin type.*
Paul Terwilliger, University of Wisconsin, Madison (859-05-107)

3:00 p.m. (209) *On the diameter of Cayley graphs of permutation groups.*
Laszlo Babai, University of Chicago, and **Akos Seress***, Ohio State University, Columbus (859-05-148) (Sponsored by Dwijendra K. Ray-Chaudhuri)

AMS Special Session on Ring Theory, IV

1:00 p.m.–3:20 p.m.

1:00 p.m. (210) *The structure of Johns rings.*
Carl Faith*, Rutgers University, New Brunswick, and **Pere Menal**, University Autonoma de Barcelona, Spain (859-16-65)

1:30 p.m. (211) *On right perfect localizations.*
Seog-Hoon Rim, **Mark L. Teply***, University of Wisconsin, Milwaukee, and **Blas Torrecillas**, University of Granada, Spain (859-16-12)

2:00 p.m. (212) *Minimal cogenerators need not be unique.*
Barbara L. Osofsky, Rutgers University, New Brunswick (859-16-50)

2:30 p.m. (213) *Uniform modules over serial rings.*
Bruno J. Mueller*, McMaster University, and **Surjeet Singh**, Kuwait University, Kuwait (859-16-78)

3:00 p.m. (214) *The second layer condition, links and localization in serial rings with Krull dimension.*
Mary H. Wright, Southern Illinois University, Carbondale (859-16-25)

MAA Minicourse #10: Part B

1:00 p.m.–3:00 p.m.

CAS laboratory projects for calculus. **Carl Leinbach**, Gettysburg College

MAA Minicourse #8: Part B

1:00 p.m.–3:00 p.m.

A mathematician's introduction to the HP-48SX scientific expandable calculator for first-time users. **John Kenelly** and **Don LaTorre**, Clemson University

AMS Session on Function Spaces

1:00 p.m.–3:10 p.m.

1:00 p.m. (215) *The geometry of harmonic mappings.*
Abdallah Lyzzaik, Kuwait University, Kuwait (859-30-02)

1:15 p.m. (216) *Linear functionals on some weighted Bergman spaces.*
Maher M. H. Marzuq, Kuwait University, Kuwait (859-30-03)

1:30 p.m. (217) *Homogeneous polynomials on L_p-spaces.* Preliminary report.
K. Sundaresan, Cleveland State University (859-42-21)

1:45 p.m. (218) *Approximation by partial sums of Fourier series.* **Syed M. Mazhar**, Ohio State University, Columbus and Kuwait University, Kuwait (859-42-93)

2:00 p.m. (219) *Multi-tuple Shilov boundaries for function spaces.* Preliminary report. **Toma Tonev**, University of Toledo and Institute of Mathematics, Bulgaria (859-46-157)

2:15 p.m. (220) *Range inclusion and factorization of operators on classical Banach spaces.* **Alfred D. Andrew**, Georgia Institute of Technology, and **W. M. Patterson***, Spelman College (859-47-115)

2:30 p.m. (221) *Maxwell's principle for Lagrangian saddle functions.* Preliminary report. **Gregory B. Passty**, Southwest Texas State University (859-47-114)

2:45 p.m. (222) *Diagonal operators in ideals.* **Michael Hoffman**, California State University, Los Angeles (859-47-159)

3:00 p.m. (223) *Relations with composition products of set-valued mappings.* **Frank U. Williamson**, Vitry, France (859-49-20)

AMS Session on Numerical Methods and Mathematical Modelling

1:00 p.m.–2:40 p.m.

1:00 p.m. (224) *Random processes of the form* $x_{n+1} = a_n x_n + b_n \pmod p$. **Martin Hildebrand**, Harvard University (859-60-89)

1:15 p.m. (225) *More about two-parameter SOR method.* **Saadat Moussavi**, University of Wisconsin, Oshkosh (859-65-134)

1:30 p.m. (226) *Low velocity expressions for the force between moving charges.* **Domina Eberle Spencer***, University of Connecticut, Storrs, and **Shama Y. Uma**, Bridgewater State College (859-78-112)

1:45 p.m. (227) *A two-layer compressible/incompressible mathematical model of ice deformation.* Preliminary report. **William A. Jones, Jr.**, Byrd Polar Research Center and Ohio State University, Columbus (859-86-135)

2:00 p.m. (228) *An investigation into the mathematics behind allometry.* **Sue Ann Gaster**, College of Saint Mary (859-92-156) (Sponsored by John N. Mordeson)

2:15 p.m. (229) *Geographic location theory: Selected topics.* **Sandra L. Arlinghaus**, Institute of Mathematical Geography (859-51-116)

2:30 p.m. (230) *Introductory linear algebra and computers.* Preliminary report. **Firooz Khosraviyani**, University of Texas at Permian Basin (859-15-140)

AMS Session on Differential and Integral Equations

1:00 p.m.–3:10 p.m.

1:00 p.m. (231) *A note on the gap between the first two eigenvalues of one dimensional Schrodinger operator with symmetric potential.* **Shoshana Abramovich**, Connecticut College (859-34-14)

1:15 p.m. (232) *Quasilinear Jacobi differential equations.* Preliminary report. **Victor L. Shapiro**, University of California, Riverside (859-34-53)

1:30 p.m. (233) *Nonlinear matrix differential equations.* **John Jones, Jr.**, Air Force Institute of Technology (859-34-91)

1:45 p.m. (234) *A remark on the periodic solutions of autonomous second order differential equations.* **Pablo M. Salzberg*** and **B. Mehri**, University of Puerto Rico (859-34-160)

2:00 p.m. (235) *Local existence and uniqueness of solutions of degenerate parabolic equations.* **Jeffrey R. Anderson**, Ball State University (859-35-11)

2:15 p.m. (236) *Lax pairs, recursion operators and perturbations of integrable evolution equations.* **Russell L. Herman**, Saint Lawrence University (859-35-01)

2:30 p.m. (237) *Existence and uniqueness of bounded solutions of pertubed integral equations.* Preliminary report. **M. N. Islam**, University of Dayton (859-45-43)

2:45 p.m. (238) *Characterization of the Meijer transform.* **Elias Y. Deeba***, University of Houston, Downtown, and **E. L. Koh**, University of Regina (859-44-76)

3:00 p.m. (239) *Generalized Hilbert's 16th problem.* **Ping-Xing Sheng**, State University of New York, Buffalo and University of California, Los Angeles (859-34-09)

MAA Earle Raymond Hedrick Lectures: Lecture III

1:15 p.m.–2:15 p.m.

(240) *Spirals from Theodorus of Cyrene to meta-chaos. Theodorus goes wild.* **Philip J. Davis**, Brown University

Saturday, August 11 (cont'd)

MAA-AMATYC Invited Address

2:30 p.m.–3:20 p.m.

(241) *Crisis in mathematics education: Perspective from the two-year college.*
Karl J. Smith, Santa Rosa Junior College

MAA Minicourse #11: Part B

3:15 p.m.–5:15 p.m.

Producing mathematics courseware with Mathematica: Calculus and Mathematica. **Don Brown, Horacio Porta** and **Jerry Uhl**, University of Illinois, Urbana

MAA Minicourse #13: Part B

3:15 p.m.–5:15 p.m.

Spreadsheet based mathematical topics for nonmathematics majors. **V. S. Ramamurti**, University of North Florida

AMS Progress in Mathematics Lecture

3:35 p.m.–5:05 p.m.

(242) *Λ-trees and their applications.*
John W. Morgan, Columbia University
(859-20-167)

MAA Committee on the Participation of Women Special Lecture

3:35 p.m.–4:25 p.m.

History of women in the MAA.

W. Wistar Comfort
AMS Associate Secretary
Middletown, Connecticut

Kenneth A. Ross
MAA Secretary
Eugene, Oregon

Presenters of Papers

Numbers following the names indicate the speakers' positions on the program.

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Amherst, Massachusetts
University of Massachusetts, Amherst
October 20 – 21

First Announcement

The eight-hundred-and-sixtieth meeting of the American Mathematical Society will be held at the University of Massachusetts, Amherst, Massachusetts, on Saturday, October 20, and Sunday, October 21, 1990. All scientific sessions will be held in the Lederle Graduate Research Tower and several nearby buildings.

Invited Addresses

By invitation of the Eastern Sectional 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:

CHRISTOPHER B. CROKE, University of Pennsylvania, *On the rigidity induced by the length of geodesics; problems and recent progress*, 11:00 a.m. Saturday.

WILLIAM M. GOLDMAN, University of Maryland, College Park, *Complex hyberbolic Kleinian groups*, 11:00 a.m. Sunday.

HENRY P. MCKEAN JR., New York University, Courant Institute, *Two symplectic structures*, 1:30 p.m. Sunday.

JOHN J. MALLET-PARET, Brown University, *Global dynamics of delay differential equations*, 1:30 p.m. Saturday.

Special Sessions

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

Hyperbolic manifolds, COLIN C. ADAMS, Williams College.

Lattices, geometry, and combinatorics, M. K. BENNETT, University of Massachusetts, Amherst, and GARRETT BIRKHOFF, University of Massachusetts, Amherst.

Non-linear mathematics in mathematics and science, MELVYN BERGER and ROBERT GARDNER, University of Massuchusetts, Amherst.

Semigroups, HASKELL COHEN, University of Massachusetts, Amherst.

Discrete groups and geometric structures in 2, 3, and 4 dimensions, WILLIAM M. GOLDMAN, and BERNARD MASKIT, SUNY at Stony Brook.

Lie groups and algebraic groups, JAMES E. HUMPHREYS, and IVAN MIRKOVIĆ, University of Massachusetts, Amherst.

Algebraic graph theory, CHJAN LIM, Rensselaer Polytechnic Institute.

Ergodic theory, V. S. PRASAD, University of Lowell.

Aperiodicity and order, CHARLES RADIN, University of Texas, Austin, and MARJORIE SENECHAL, Smith College.

Abstracts for consideration for these sessions should have been submitted by the **July 16, 1990** deadline. This deadline was previously published in the Calendar of AMS Meetings and Conferences and in the Invited Speakers and Special Sessions section of the *Notices*.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, **so as to arrive before the August 6, 1990 abstract deadline**. Participants are reminded that a charge of $16 is imposed for retyping abstracts that are not in camera-ready form. Late papers will not be accommodated.

Electronic Submission of Abstracts

This service is now 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: American Mathematical Society, Publications Division, P.O. Box 6248, Providence, RI 02940, USA. When re-

questing the abstracts package, users should be sure to specify whether they want the plain TEX, AMS-TEX, or the LATEX package.

Registration

The registration desk will be located in the 16th floor lobby of the Lederle Graduate Research Tower and will be open from 8:00 a.m. to 5:00 p.m. on Saturday, October 20, and, from 8:00 a.m. to noon on Sunday, October 21. The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians.

Other Events of Interest

On Friday, October 19, there will be an international symposium on *Nonlinear Dynamics in Mathematics and Science*, hosted by the University of Massachusetts, Amherst, Department of Mathematics and Statistics, and sponsored by the Office of Naval Research. This conference will take place between 10:00 a.m. until the late evening in a single location convenient to the Mathematics Department. Many distinguished mathematicians and scientists from this country and abroad (Soviet Union, England, and Japan) have been invited to participate in this major event. Here is a chance to learn of many of the major research developments in this field and to meet many of the major contributors–all in one day. The invited participants include R. Coifman, R. Devaney, V. Dobrushin, C. Foias, L. E. Fraenkel, C. Jones, V. Judovich, G. Knightly, O. Ladyhenskaya, H. Matano, H. McKean, A. Polyakov, J. T. Stuart,, and J. Toland. In relation to the conference there will be a two-day Special Session of invited talks on nonlinear dynamics on Saturday and Sunday organized by M. S. Berger and R. Gardner.

Social Event

There will be a social event hosted by the Department of Mathematics and Statistics, late Saturday afternoon.

Petition Table

A petition table will be set up in the registration area. Additional information about petition tables can be found in a box in the Columbus meeting announcement in the April 1990 issue of *Notices*.

Accommodations

Rooms have been blocked for participants at the following hotels or motels in the area. Because of the popularity of the New England fall foliage, hotel/motel reservations should be made as soon as possible. Participants should make their own reservations directly and mention the AMS meeting. The deadline for reservations at the Lincoln Campus Center is September 29th: Lord Jeffery Inn, October 5th; Motel 6, September 30th; Country Belle Motel, September 9th; Howard Johnson Motel, September 19th; and University Motor Lodge, August 19th.

Country Belle Motel (two miles from campus)
392 Russell Street, Hadley, MA 01035 (Rte.9)
Telephone: 413-586-0715

Single $54.00 Double $54.00

Howard Johnson Motel (two miles from campus)
401 Russell Street, Hadley, MA 01035 (Rte.9)
Telephone: 413-586-0114

Single $85.00 Double $85.00

Lincoln Campus Center Hotel (on campus)
University of Massachusetts, Amherst, MA 01003
Telephone: 413-549-6000

Single $54.00 Double $64.00

Lord Jeffery Inn (one mile from campus)
30 Boltwood Avenue, Amherst, MA 01002
Telephone: 413-253-2576

Single $80.00 Double $80.00

Motel 6 (ten miles from campus)
State Road, (I-91 Exit 24, North rte. 5 and 10), South Deerfield, MA 01373
Telephone: 413-665-7161

Single $29.56 Double $36.15

University Motor Lodge (1/4 mile from campus)
345 North Pleasant Street, Amherst, MA 01002
Telephone: 913-527-8468

Single $67.00 Double $67.00

Food Service

Meals will be available at the following campus locations. Saturday only: Top of the Campus Restaurant (located in Lincoln Campus Center on the 11th floor) Hours from 5:00 p.m. to 9:00 p.m.

Saturday and Sunday: Hatch Cafeteria 8:00 a.m. - 10:30 p.m. Saturday: Newman Center 8:30 a.m. - 4:00 p.m Sunday: Newman Center 8:30 a.m. - 10:00 p.m.

Parking

Parking will be permitted in any of the parking lots on campus from 6:00 p.m. Friday until 7:00 a.m. Monday at no charge. The only restrictions apply to spaces indicated as reserved for handicapped or towing zone

areas. Parking at other hours is available for a fee at the parking garage adjacent to the Lincoln Campus Center.

Travel and Local Information

The University of Massachusetts, Amherst, is accessible by air, bus, or car. In the town of Amherst there is no taxi service but it is expected that Pioneer Valley Transit Authority (PVTA) bus service will be available to and from the campus. Amherst is approximately a one-hour drive from Bradley International Airport in Windsor Locks, Connecticut, which is served by such major airlines as American, Delta, Eastern, TWA, United, and USAIR.

Participants are advised to fly in and out of Bradley since it is closer and more convenient than Logan International Airport in Boston. Peter Pan Bus Line is available at Bradley and runs directly to the campus. Peter Pan presently operates daily between the hours of 7:00 a.m. and 8:15 p.m. (10:15 p.m. on Friday). Return buses to Bradley from the campus presently operate daily from 5:05 a.m. until 6:20 p.m. (8:20 p.m on Sunday).

Most major car rental companies have agencies at Bradley International Airport. Directions for participants driving to the meeting are as follow:

FROM THE NORTH: Route 91 South to Exit 25 (South Deerfield) onto Route 116 South to UMass Exit onto Massachusetts Avenue.

FROM THE SOUTH: Route 91 North to Exit 19 (Amherst) onto Route 9 to Route 116 North (left turn at lights) to UMass Exit onto Massachusetts Avenue (turn right).

FROM THE EAST: Massachusetts Turnpike (Route 90) West to Exit 4 (West Springfield), onto Route 91 North (Holyoke Exit) to Exit 19 (Amherst), onto Route 9 to Route 116 North (left turn at lights), to UMass Exit onto Massachusetts Avenue (turn right).

FROM THE WEST: Massachusetts Turnpike (Route 90) to Exit 4 (West Springfield), onto Route 91 North (Holyoke Exit) to Exit 19 (Amherst), onto Route 9 to Route 116 North (left turn at lights) to UMass Exit onto Massachusetts Avenue (turn right).

Weather and Local Attractions

Weather conditions in October can vary greatly. Balmy Indian Summer weather is expected, but rapid changes in conditions have brought on snow storms in the past. Participants should be prepared for both warm and cold conditions.

W. Wistar Comfort
Associate Secretary
Middletown, Connecticut

ALMOST PERIODIC MEASURES

Loren N. Argabright and Jésus Gil de Lamadrid

(Memoirs of the AMS, Number 428)

In this book, the authors provide a thorough and organized presentation of a substantial portion of current research in abstract harmonic analysis carried out on three continents, in a field that has been characterized by multiple rediscoveries of results and concepts by authors unaware of the work of others. The book recasts the classical theory of H. Bohr of almost periodic functions in a form sufficiently abstract and general as to encompass not only Bohr's original theory, but also more recent manifestations of almost periodicity in the work of Wiener, Stepanov, Besicovitch, Eberlein, and Jacobs. A substantial portion of the book is devoted to the application of the general theory to the study of mixed norm (amalgam) space and to the study of the general Fourier transform introduced by the same authors in an earlier work (*Memoirs of the AMS*, Number 145). The present book builds on basic notions and systematically develops the concepts and results in a leisurely manner from the general to the concrete, with each step leading naturally to the next. In addition, it provides a simple, general framework for formulating and proving general results, which easily lead to many major, loosely related results in the existing literature.

Requiring a solid grounding in the theory of locally compact abelian groups and abstract (or classical) Fourier analysis, this book will be of interest to advanced graduate students in abstract harmonic analysis and topological representation theory, as well as to researchers in Fourier analysis, almost periodicity, and ergodic theory.

1980 Mathematics Subject Classifications: 43
ISBN 0-8218-2490-2, LC 90-31823, ISSN 0065-9266
219 pages (softcover), May 1990
Individual member $16, List price $26,
Institutional member $21
To order, please specify MEMO/428NA

All prices subject to change. Shipment will be made by surface. For air delivery add, 1st book $5, each additional book $3, maximum $100. *Prepayment required.* **Order from** American Mathematical Society, P.O. Box 1571, Annex Station, Providence, RI 02901-1571, or call toll free 800-321-4AMS (321-4267) in the continental U.S. and Canada to charge with VISA or MasterCard.

Denton, Texas
University of North Texas
November 2 – 3

First Announcement

The eight-hundred-and-sixty-first meeting of the American Mathematical Society will be held at University of North Texas, Denton, Texas on Friday, November 2, and Saturday, November 3, 1990. All scientific sessions will be held in the Union Building on the campus.

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:

AVNER D. ASH, Ohio State University, *Title to be announced.*

PETER S. CONSTANTIN, University of Chicago, *Title to be announced.*

JOHN E.LUECKE, University of Texas, Austin, *Title to be announced.*

CLARENCE WILKERSON, Perdue University, *Title to be announced.*

Special Sessions

By invitation of the same committee, there will be eleven Special Sessions of selected twenty-minute papers. The topics, and the names and affiliations of the organizers, are as follows:

Arithmetic groups, AVNER D. ASH and MARK S. REEDER, University of Oklahoma.

Geometric inequalities and convex bodies, ILYA BAKELMAN, Texas A & M University.

Banach spaces-functional analysis, ELIZABETH M. BATOR, RUSSELL G. BILYEU, and PAUL W. LEWIS, University of North Texas, Denton.

Commutative algebra, SCOTT T. CHAPMAN, Trinity University, and NICK H. VAUGHN, University of North Texas, Denton.

Texas topology and geometry, DANIEL S. FREED, ROBERT F. WILLIAMS, and MICHAEL WOLF, University of Texas, Austin.

The probability theory of patterns and runs, ANANT P. GODBOLE, Michigan Technological University.

Low dimensional topology, JOHN LUECKE and ROBERT MYERS, Oklahoma State University.

Representation theory of Lie groups,LISA MANTINI and ROGER C. ZIERAU, Oklahoma State University

Differential equations, JOHN W. NEUBERGER and HENRY A. WARCHALL, University of North Texas, Denton.

Albebraic geometry, PETER F. STILLER, Texas A & M University.

Several complex variables, EMIL J. STRAUBE, Texas A & M University.

Abstracts for consideration for these sessions should have been submitted by the **July 16, 1990** deadline. This deadline was previously published in the Calendar of AMS Meetings and Conferences and in the Invited Speakers and Special Sessions section of the *Notices.*

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, **so as to arrive before the August 6, 1990 abstract deadline.** Participants are reminded that a charge of $16 is imposed for retyping abstracts that are not in camera-ready form. Late papers will not be accommodated.

Electronic Submission of Abstracts

This service is now 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: 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.

Registration

The meeting registration desk will be located in the Gallery Reception Area in the Union Building and will be open from 7:00 p.m. to 9:00 p.m. on Thursday, from 8:00 a.m. to 2:00 p.m. on Friday, and from 8:00 a.m. to noon on Saturday. The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians.

Petition Table

A petition table will be set up in the registration area. Additional information about petition tables can be found in a box in the Columbus meeting announcement in the April 1990 issue of *Notices*.

Accommodations

Special rates have been negotiated at selected local hotels, all of which are located on the I-35 corridor. Both the Royal Hotel Suites and the Sheraton are within easy walking distance of the campus. Participants should make their own arrangements directly with the hotel of their choice and ask for the special AMS meeting rate. The rates listed are subject to change and do not include applicable taxes. The deadline for reservation at all locations is **October 1, 1990 to obtain the published rates**. The AMS is not responsible for rate changes or accommodations offered by hotels/motels.

Holiday Inn (2.5 miles from campus)
1500 Dallas Drive, Denton, TX 76205
Telephone: 817-387-3511

Single $40.00 Double $40.00

LaQuinta Motor Inn (1.5 miles from campus)
700 Fort Worth Drive, Denton, TX 76205
Telephone: 817-387-5840

Single $31.00 Double $36.00

Motel 6 (3 miles from campus)
I-35 North of University Drive, Denton, TX 76205
Telephone: 817-566-4798

Single $21.95 Double $27.95

Auburn Inn (2 miles from campus)
820 S I-35E at Teasley Lane, Denton, TX 76205
Telephone: 817-387-0591

Single $35.00 Double $35.00

Royal Hotel Suites (.5 miles from campus)
1210 I-35E, Denton, TX 76205
Telephone: 817-383-2007

Single $24.00 Double $34.00

Sheraton Hotel (.5 miles from campus)
2211 I-35E, Denton, TX 76205
Telephone: 817-565-8499

Single $53.00 Double $58.00

Food Service

Many fast food restaurants are located within two blocks of the campus, and more formal dining is available at the Sheraton Hotel and several local restaurants. Food service in the Union will only be available according to the following schedule: Breakfast, lunch, and sandwiches until 5:00 p.m. on Thursday; breakfast and lunch on Friday; and lunch only on Saturday.

Travel

Denton is located approximately 35 miles north of Dallas and Fort Worth and 25 miles north of DFW International Airport, which is served by most major airlines. Airport shuttle service is available from the DFW International Airport to Denton (Telephone 817-565-9936 two to five days in advance for reservations). However, since one-way fare is $16 and only the Royal Hotel Suites and the Sheraton Hotel are within easy walking distance from campus, those flying to DFW should consider renting a car and driving to Denton.

Weather

Autumn in North Texas is a pleasant season with mild, sunny weather punctuated by short periods of rainfall. The average temperature for November is 61.5 degrees Fahrenheit with relative humidity around 55 percent. The average date of the first freeze is November 8.

Andy Roy Magid
Associate Secretary
Norman, Oklahoma

Irvine, California
University of California, Irvine
November 10 – 11

First Announcement

The eight-hundred-and-sixty-second meeting of the American Mathematical Society will be held at the University of California, Irvine (UCI) campus at Campus Blvd in Irvine, California on Saturday, November 10th, and Sunday, November 11th, 1990. All Special Sessions and sessions for contributed papers will be held in the Physical Sciences complex: Physical Sciences I or II, the Physical Sciences Lecture Hall or the Physical Sciences Lecture Facility. This meeting will be held in conjunction with a meeting of the Southern California Section of the Mathematical Association of America.

Invited Addresses

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

JENNIFER T. CHAYES, University of California, Los Angeles, *Nature of the critical phenomonen in self-organized criticality.*

MICHAEL D. FRIED, University of California, Irvine, *Parameter spaces in the inverse Galois Problem.*

NICHOLAS J. KOREVAAR, University of Utah, *Constant mean curvature surfaces.*

Special Sessions

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

Combinatorial groups, FRANK CANNITTO, University of California, Irvine.

Probability theory in mathematical physics, JENNIFER T. CHAYES, and GLEN H. SWINDLE, University of California, Los Angeles.

Interactions between group theory and logic, PAUL C. EKLOF, University of California, Irvine.

Interactions between group theory and geometry/number theory, MICHAEL D. FRIED and ROBERT M. GURALNICK, University of California, Irvine.

Moduli space applications, MICHAEL D. FRIED and DAVID HARBATER, University of California, Irvine.

Quantum and statistical mechanics, ABEL KLEIN, University of California, Irvine.

Geometric p.d.e.'s: mean and scalar curvature problems, NICHOLAS J. KOREVAAR and ANDREJS E. TREIBERGS, University of Utah.

Operator theory/operator algebras, BERNARD RUSSO, University of California, Irvine.

Abstracts for consideration for these sessions should have been submitted by the **July 16, 1990** deadline. This deadline was previously published in the Calendar of AMS Meetings and Conferences and in the Invited Speakers and Special Sessions section of the *Notices*.

Contributed Papers

There will also be sessions for contributed ten-minute papers. Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in Departments of Mathematics. Abstracts should be sent to the Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, **so as to arrive before the August 6, 1990 abstract deadline**. Participants are reminded that a charge of $16 is imposed for retyping abstracts that are not in camera-ready form. Late papers will not be accommodated.

Electronic Submission of Abstracts

This service is now available to those who use the TEX typesetting system and can be used with abstracts of papers to be presented at the spring 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: 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.

Registration

The meeting registration desk will be located in the lobby of the Physical Sciences II building, near Parking Lot 12, and will be open from 8:00 a.m. to 4:00 p.m. on Saturday, and 8:00 a.m. to noon on Sunday. The registration fees are $30 for members of the AMS, $45 for nonmembers, and $10 for students or unemployed mathematicians. There is a special one-day fee of $15 for MAA members on Saturday only.

Social Event

The MAA portion of the Conference will have a luncheon speaker, Harvey B. Keynes. On Saturday night, various of the Special Session organizers have been encouraged to arrange a dinner of Special Session attendees and speakers. Participants are encouraged to ask any Special Session organizer about this event.

Petition Table

A petition table will be set up in the registration area. Additional information about petition tables can be found in a box in the Columbus meeting announcement in the April 1990 issue of *Notices*.

Accommodations

Unfortunately, there is no housing available on the campus during the year; however, four of the hotels do offer shuttle service to UCI. All hotels offer shuttle service to and from Orange County Airport (on MacArthur Blvd) and taxi service is available from each hotel to the UCI campus. Hotel listings will appear in the September *Notices*.

Food Service

On the UCI campus, lunch will be available at "Joe's on the Green," which serves hefty sandwiches, many flavors of pizza, pasta, beer, wine, etc. It will be open especially for the conference and service is expected to be excellent. For more formal dining, the "Market Place" across from Campus Boulevard has wonderful shops and at least four restaurants, one of them serving Chinese food.

Travel

There are two convenient airports to the conference: Los Angeles International Airport (LAX) and Orange County Airport (OCA)) also known as the **John Wayne Airport**. Shuttle service is available to UCI or to any of the hotels from OCA. There is also a convenient shuttle or bus service from LAX to OCA. For participants traveling by car to the campus, please see the following directions:
LAX to MacArthur Boulevard: When leaving LAX, take the Sepulveda exit. Stay in the right lane on Sepulveda until you see a sign that says **405 South**. Turn right at that corner and then immediately get in the left lane for the marker indicating the entrance to the freeway. After merging into the freeway traffic, drive (for approximately 45 minutes) until you see the exit across from OCA. The streets for Irvine include MacArthur Blvd, Jamboree, and Culver. Turn left on **MacArthur Blvd**, heading for the beach. Drive approximately five minutes past Jamboree and under a viaduct, to **University Ave** exit. At that point, you will see a sign for UCI; turn right and drive down the long exit ramp to the bottom of the hill. Turn right and enter the campus on the first street, **California Street**. Follow the signs to the parking Kiosk, the Sciences Complex and Parking Lot 12.

Parking

The UCI Physical Sciences Complex is located near a collection of large parking lots on Circle Drive. Principal among these is Parking Lot 12. There is no parking fee on Sunday. Kiosks for the parking stickers for Saturday are located at all three large entrance streets (California, Bridge, and Berkeley) to the University. Parking stickers are $4 for all day and $3 for half a day.

Weather and Local Attractions

The famous Southern California weather is characterized by warm breezes during the day—dare we say balmy—followed by cool exotic nights. Even in November, one can expect comfortable temperatures (75°F in the afternoon, 65°F in the evening). It is as advertised. The local attractions are of the nature of amusement park type: the renowned beaches (especially Main beach in Laguna Beach), the marsh lands tour on UCI campus, Disneyland, and Knotts Berry Farm (only 15 minutes from the campus). A special tour of the marsh lands has been arranged for Saturday, November 10, at 10:00 a.m. For the serious shopper, *Fashion Island* is the place to go. It is the closest thing in the UCI area to Rodeo Drive and it is much prettier. Finally, the search for quintissential Southern California ends at Balboa Island. This combines fantastic dining and viewing on an inlet.

Lance W. Small
Associate Secretary
La Jolla, California

Invited Speakers and Special Sessions

Invited Speakers at AMS Meetings

The individuals listed below have accepted invitations to address the Society at the times and places indicated. For some meetings, the list of speakers is incomplete.

Amherst, MA, October 1990

Christopher B. Croke
William M. Goldman
John J. Mallet-Paret
Henry P. McKean, Jr.

Denton, TX, November 1990

Avner D. Ash
Peter S. Constantin
John Luecke
Clarence W. Wilkerson

Irvine, CA, November 1990

Jennifer T. Chayes
Michael D. Fried
Nicholas J. Korevaar

San Francisco, CA, January 1991

Michael F. Atiyah (Gibbs Lecture)
Shiing S. Chern (AMS/MAA Lecture)
Rebecca A. Herb (AMS/MAA Lecture)
Maria M. Klawe
Robert D. MacPherson (Colloquium Lectures)
Grigorii Aleksandrovič Margulis
Frank Morgan (AMS/MAA Lecture)
Kenneth A. Ribet
Héctor J. Sussmann

South Bend, IN, March 1991

Leonid G. Makar-Limanov
Donald G. Saari
Stephen D. Smith
Deane Yang

Tampa, FL, March 1991

Josefina Alvarez
Ronald A. DeVore
Michel L. Lapidus
Donald St. P. Richards

Orono, ME, August 1991

Richard M. Schoen (Progress in Mathematics Lecture)

Fargo, ND, October 1991

Ian D. Macdonald
Harald Upmeier
Sylvia M. Wiegand

Baltimore, MD, January 1992

Michael E. Fisher (Gibbs Lecture)

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

Organizers and Topics of Special Sessions

The list below contains all the information about Special Sessions at meetings of the Society available at the time this issue of *Notices* went to the printer. The section below entitled **Information for Organizers** describes the timetable for announcing the existence of Special Sessions.

October 1990 Meeting in Amherst, Massachusetts
Eastern Section
Associate Secretary: W. Wistar Comfort
Deadline for organizers: Expired
Deadline for consideration: Expired

Colin C. Adams, *Hyperbolic manifolds*

M. K. Bennett and Garrett Birkhoff, *Lattices, geometry, and combinatorics*

Melvyn S. Berger and Robert A. Gardner, *Nonlinear dynamics in mathematics and science*

Haskell Cohen, *Semigroups*

William M. Goldman and Bernard Maskit, *Discrete groups and geometric structures in 2, 3 and 4 dimensions*

James E. Humphreys and Ivan Mirković, *Lie groups and algebraic groups*

Chjan C. Lim, *Algebraic graph theory*

V. S. Prasad, *Ergodic theory*
Charles Radin and Marjorie Senechal, *Aperiodicity and order*

November 1990 Meeting in Denton, Texas
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: Expired

Avner D. Ash and Mark S. Reeder, *Arithmetic groups*
Elizabeth M. Bator, Russell G. Bilyeu and Paul W. Lewis, *Banach spaces—functional analysis*
Ilya Bakelman, *Geometric inequalities and convex bodies*
Scott T. Chapman and Nick H. Vaughan, *Commutative algebra*
Daniel S. Freed, Robert F. Williams and Michael Wolf, *Texas topology and geometry*
Anant P. Godbole, *The probability theory of patterns and runs*
John Luecke and Robert Myers, *Low dimensional topology*
Lisa Mantini and Roger C. Zierau, *Representation theory of Lie groups*
John W. Neuberger and Henry A. Warchall, *Differential equations*
Peter F. Stiller, *Algebraic geometry*
Emil J. Straube, *Several complex variables*

November 1990 Meeting in Irvine, California
Western Section
Associate Secretary: Lance W. Small
Deadline for organizers: Expired
Deadline for consideration: Expired

Frank Cannitto, *Combinatorial groups*
Jennifer T. Chayes and Glen H. Swindle, *Probability theory in mathematical physics*
Paul C. Eklof, *Interactions between group theory and logic*
Michael D. Fried and Robert M. Guralnick, *Interactions between group theory and geometry/number theory*
Michael D. Fried and David Harbater, *Moduli space applications*
Abel Klein, *Quantum and statistical mechanics*
Nicholas J. Korevaar and Andrejs E. Treibergs, *Geometric p.d.e.'s: mean and scalar curvature problems*
Bernard Russo, *Operator theory/operator algebras*

January 1991 Meeting in San Francisco, California
Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: September 19, 1990

Alok Aggarwal and Maria M. Klawe, *To be announced*
Frederick J. Almgren, Albert Marden and Jean E. Taylor, *Computing optimal geometries*
William Beckner and J. Michael Pearson, *Geometric Fourier analysis*
Melvyn S. Berger, *Turbulence*
Bruce E. Blackadar, *C* - algebras and noncommutative topology*
Ed Dubinsky and James J. Kaput, *Research in undergraduate education* (AMS/MAA Session)
Naomi Fisher, Harvey B. Keynes and Philip D. Wagreich, *Mathematics and education reform*
John R. Graef and Jack K. Hale, *Oscillation and dynamics in delay equations*
Kevin A. Grasse and Héctor J. Sussmann, *To be announced*
Helmut Groemer and Jane Yeager, *Analytical methods in convexity*
William B. Jacob, *Real algebraic geometry*
Victor J. Katz and David E. Rowe, *History of mathematics*
Esther R. Lamken, *Combinatorial design theory*
Kirk E. Lancaster, *Boundary behavior in partial differential equations*
M. Susan Montgomery and Earl J. Taft, *Hopf algebras*
David Mumford, *Automatic theorem proving*
Kenneth A. Ribet, *Arithmetical algebraic geometry*
Lester J. Senechal, *Research papers by undergraduates*
Antoinette Trembinska, *Entire function theory*

March 1991 Meeting in South Bend, Indiana
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: Expired
Deadline for consideration: December 13, 1990

Gail R. Letzter, Peter Malcolmson and Frank Okoh, *Noncommutative ring theory*

March 1991 Meeting in Tampa, Florida
Southeastern Section
Associate Secretary: Joseph A. Cima
Deadline for organizers: Expired
Deadline for consideration: December 13, 1990

June 1991 Meeting in Portland, Oregon
Western Section
Associate Secretary: Lance W. Small
Deadline for organizers: September 13, 1990
Deadline for consideration: March 5, 1991

August 1991 Meeting in Orono, Maine
Associate Secretary: Lance W. Small
Deadline for organizers: November 15, 1990
Deadline for consideration: May 8, 1991

October 1991 Meeting in Philadelphia, Pennsylvania
Eastern Section
Associate Secretary: W. Wistar Comfort
Deadline for organizers: January 10, 1991
Deadline for consideration: July 11, 1991

October 1991 Meeting in Fargo, North Dakota
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: January 25, 1991
Deadline for consideration: July 11, 1991
Dogan Comez, *Ergodic theory*
Kendall E. Nygard, *Operations research*
James H. Olsen and Mark Pavicic, *Mathematical foundations of computer graphics*
Warren E. Shreve, *Graph theory*
Vasant A. Ubhaya, *Approximation theory*

November 1991 Meeting in Santa Barbara, California
Western Section
Associate Secretary: Lance W. Small
Deadline for organizers: February 7, 1991
Deadline for consideration: August 20, 1991

January 1992 Meeting in Baltimore, Maryland
Associate Secretary: W. Wistar Comfort
Deadline for organizers: April 8, 1991
Deadline for consideration: September 11, 1991

March 1992 Meeting in Tuscaloosa, Alabama
Southeast Section
Associate Secretary: Joseph A. Cima
Deadline for organizers: June 13, 1991
Deadline for consideration: To be announced

March 1992 Meeting in Springfield, Missouri
Central Section
Associate Secretary: Andy R. Magid
Deadline for organizers: June 26, 1991
Deadline for consideration: To be announced

June 1992 Meeting in Cambridge, England
Associate Secretary: Robert M. Fossum
Deadline for organizers: September 28, 1991
Deadline for consideration: To be announced

January 1993 Meeting in San Antonio, Texas
Associate Secretary: Lance W. Small
Deadline for organizers: April 13, 1992
Deadline for consideration: To be announced

August 1993 Meeting in Vancouver, British Columbia, Canada
Associate Secretary: Andy R. Magid
Deadline for organizers: November 11, 1992
Deadline for consideration: To be announced

January 1994 Meeting in Cincinnati, Ohio
Associate Secretary: Joseph A. Cima
Deadline for organizers: April 5, 1993
Deadline for consideration: To be announced

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

Information for Organizers

Special Sessions at Annual and Summer Meetings are held under the supervision of the Program Committee for National Meetings (PCNM). They are administered by the Associate Secretary in charge of that meeting with staff assistance from the Meetings and Editorial Departments in the Society office in Providence.

According to the "Rules for Special Sessions" of the Society, Special Sessions are selected by the PCNM from a list of proposed Special Sessions in essentially the same manner as Invited Speakers are selected. The number of Special Sessions at a Summer or Annual Meeting is limited. The algorithm that determines the number of Special Sessions allowed at a given meeting, while simple, is not repeated here, but can be found in "Rules for Special Sessions" on page 614 in the April 1988 issue of *Notices*.

Each Invited Speaker is invited to generate a Special Session, either by personally organizing one or by having a Special Session organized by others. Proposals to organize a Special Session are sometimes requested either by the PCNM or by the Associate Secretary. Other proposals to organize a Special Session may be submitted to the Associate Secretary in charge of that meeting (who is an *ex-officio* member of the committee and whose address may be found below). These proposals must be in the hands of the PCNM at least nine months prior to the meeting at which the Special Session is to be held in order that the committee may consider all the proposals for Special Sessions simultaneously. Proposals that are sent to the Providence office of the Society, to *Notices*, or directed to anyone other than the Associate Secretary will have to be forwarded and may not be received in time to be considered for acceptance.

It should be noted that Special Sessions must be announced in *Notices* in such a timely fashion that any member of the Society who so wishes may submit an abstract for consideration for presentation in the Special Session before the deadline for such consideration. This deadline is usually three weeks before the deadline for abstracts for the meeting in question.

Special Sessions are very effective at Sectional Meetings and can usually be accommodated. The processing of proposals for Special Sessions for Sectional Meetings is handled in essentially the same manner as for Annual and Summer Meetings by the Section Program Committee. Again, no Special Session at a Sectional Meeting may be approved so late that its announcement appears past the deadline after which members can no longer send abstracts for consideration for presentation in that Special Session.

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

More precise details concerning proposals for and organizing of Special Sessions may be found in the "Rules for Special Sessions" or may be obtained from any Associate Secretary.

Proposals for Special Sessions to the Associate Secretaries

The programs of Sectional Meetings are arranged by the Associate Secretary for the section in question:

Western Section

Lance W. Small, Associate Secretary
Department of Mathematics
University of California, San Diego
La Jolla, CA 92093
Electronic mail: g_small@math.ams.com
(Telephone 619-534-3590)

Central Section

Andy R. Magid, Associate Secretary
Department of Mathematics
University of Oklahoma
601 Elm PHSC 423
Norman, OK 73019
Electronic mail: g_magid@math.ams.com
(Telephone 405-325-6711)

Eastern Section

W. Wistar Comfort, Associate Secretary
Department of Mathematics
Wesleyan University
Middletown, CT 06457
Electronic mail: g_comfort@math.ams.com
(Telephone 203-347-9411)

Southeastern Section

Joseph A. Cima, Associate Secretary
Department of Mathematics
University of North Carolina, Chapel Hill
Chapel Hill, NC 27599-3902
Electronic mail: g_cima@math.ams.com
(Telephone 919-962-1050)

As a general rule, members who anticipate organizing Special Sessions at AMS meetings are advised to seek approval at least nine months prior to the scheduled date of the meeting. No Special Sessions can be approved too late to provide adequate advance notice to members who wish to participate.

Information for Speakers

A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received in Providence prior to the special early deadline announced above and in the announcements of the meeting at which the Special Session has been scheduled. Contributors should know that there is a limitation in size of a single Special Session, so that it is sometimes true that all places are filled by invitation. Papers not accepted for a Special Session are considered as ten-minute contributed papers.

Abstracts of papers submitted for consideration for presentation at a Special Session must be received by the Providence office (Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, RI 02940) by the special deadline for Special Sessions, which is usually three weeks earlier than the deadline for contributed papers for the same meeting. The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Electronic submission of abstracts is now 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.

Joint Mathematics Meetings in San Francisco
AMS Special Sessions and Contributed Papers
MAA Contributed Papers

The Joint Mathematics Meetings in San Francisco will be held January 16–19 (Wednesday–Saturday), 1991. The first full announcement of the meeting will appear in the October 1990 issues of *Notices* and *Focus*. This preliminary announcement is made to encourage members' participation and to provide lead time for submission of abstracts for consideration in AMS Special Sessions and for submission of abstracts for AMS and MAA Contributed Paper Sessions.

AMS Special Sessions

It is hoped that the list of Special Sessions for this meeting will be available in the next issue of *Notices*

Most of the papers to be presented at these Special Sessions will be by invitation; however, anyone contributing an abstract for the meeting who feels that his or her paper would be particularly appropriate for one of these sessions should indicate this clearly on the abstract, **and should submit it by September 19, 1990, three weeks earlier than the normal deadline for contributed papers,** in order that it be considered for inclusion.

Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics, and should be sent to Abstracts, Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940. A charge of $16 is imposed for retyping abstracts that are not in camera-ready form.

AMS Contributed Paper Sessions

Abstracts should be prepared on the standard AMS form available from the AMS office in Providence or in departments of mathematics, and should be sent to Abstracts, Editorial Department, American Mathematical Society, Post Office Box 6248, Providence, Rhode Island 02940, **so as to arrive by the abstract deadline of October 10, 1990.** A charge of $16 is imposed for retyping abstracts that are not in camera-ready form. **Late papers will not be accepted.**

Electronic Submission of AMS Abstracts

This service is now available to those who use the TEX typesetting system and can be used for abstracts of papers to be presented at this meeting. Requests to obtain the package of files may be sent by electronic mail on 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: Secretary to Director of Publication, American Mathematical Society, Publications Division, P.O. Box 6248, Providence, RI 02940. When requesting the abstracts package, users should be sure to specify whether they want the plain TEX, AMS-TEX, or the LATEX package. Again, late papers will not be accepted.

MAA Contributed Papers

Contributed papers are being accepted on several topics in collegiate mathematics for presentation in contributed paper sessions at the meeting. The topics, organizers, their affiliations, and the days they will meet are:

- *Professional development for teachers of mathematics*, JOHN DOSSEY, Illinois State University, and ELIZABETH J. TELES, Montgomery College, Maryland. Wednesday and/or Thursday.

  This session is sponsored by the Committee on Faculty Development (John Dossey, chair). Papers are invited that describe departmental, system, state, regional, or sectional programs aimed at promoting continued faculty growth in mathematics or its teaching. Special consideration will be given to programs which are easily transported from one setting to another. Topics to be discussed can include, but are not limited to, the following: special faculty study programs, focused colloquia series, reading/study groups, teaching improvement programs, and the development and use of technological aids.

- *Statistics and probability*, SHELDON P. GORDON, Suffolk Community College, and FLORENCE S. GORDON, New York Institute of Technology. Friday and/or Saturday.

  Contributed papers on any issue relating to statistics and probability courses in the mathematics curriculum are welcome. For instance, 1.) What are some innovative approaches to teaching these courses (such as the use of computers and other technology, simulations, exploratory data analysis or student "research" projects)? 2.) What does statistical literacy mean for liberal arts, science, mathematics, business or social science students? 3.) What statistical ideas are being introduced into the

secondary curriculum and what are the implications for the undergraduate curriculum?

- *Alternatives to the lecture method*, JAMES R.C. LEITZEL, The Ohio State University. Friday and/or Saturday.

This session, sponsored by the Committee on the Mathematical Education of Teachers (COMET), will be devoted to classroom practices which provide alternatives to a strictly lecture approach. Papers are solicited which address strategies and techniques for classroom practice across a variety of topics in the undergraduate curriculum. Presentations which represent large and small class size and upper division as well as lower division courses are desired.

- *Humanistic mathematics*, ALVIN WHITE, Harvey Mudd College and Humanistic Math Network, MARILYN FRANKENSTEIN, University of Massachusetts, Boston, and JOAN COUNTRYMAN, Germantown Friends High School. Wednesday and/or Thursday

Contributions are invited that describe teaching, using, or creating mathematics as a humanistic discipline. The paper should describe the experience and its effect, if any, on the point of view. Philosophical and/or historical papers that contribute to mathematics as a humanistic discipline are also welcome.

- *Lesser known geometrical gems*, DON CHAKERIAN, University of California, Davis, RICHARD PFEIFER, San Jose State University, and JANE SANGWINE-YAGER, Saint Mary's College. Wednesday and/or Thursday

Contributed papers are invited which illustrate interesting but not widely known results which may be used by the teacher to enliven an upper division geometry course. These may include new insights and forgotten classics in geometry that deserve wider appreciation.

- *Using history in the teaching of mathematics*, DAVID E. ZITARELLI, Temple University. Friday and/or Saturday.

The history of mathematics is used in various ways to enrich and to teach mathematics. Papers in this session should address such uses in courses ranging from liberal arts courses for non-science majors to required courses for mathematics majors. Of particular interest are descriptions of history of mathematics courses, including graduate level courses and those designed for education majors.

Presentations are normally limited to ten minutes, although selected contributors may be given up to twenty minutes. Individuals wishing to submit papers for any of these sessions should send the following information to the MAA Washington office at 1529 Eighteenth Street, NW, Washington, DC 20036 **by September 25**:

1. A page giving the author's name, author's address, the intended session, and a one-paragraph abstract (for distribution at the meeting);
2. A one-page outline of the presentation.

Rooms where sessions of contributed papers will be held are equipped with overhead projector and screen. Blackboards are not available. Persons having other equipment needs should contact the MAA Associate Secretary (Kenneth A. Ross, Department of Mathematics, University of Oregon, Eugene, OR 97403) as soon as possible, but in any case **prior to November 16**. Upon request, the following will be made available: one additional overhead projector/screen, 35mm carousel slide projector, 16mm film projector, or VHS video cassette recorder with a color monitor.

International Congress of Mathematicians

Kyoto, JAPAN

August 21–29, 1990

List of Speakers

The following is the most current list of invited speakers just received from Kyoto. Please note that this is not the final program and is subject to change. Interested readers should refer to the Second Announcement of the Congress reproduced on pages 188 – 212 of the February 1990 issue of *Notices* for further information.

Plenary Speakers

SPENCER BLOCH, *Recent work on motifs*

STEPHEN A. COOK, *Complexity theory and logic*

BORIS L. FEIGIN, *Lie cohomological approach to conformal field theory*

ANDREAS FLOER, *Elliptic methods in Morse theory*

YASUTAKA IHARA, *Braids, Galois groups and some arithmetic functions*

VAUGHAN F. R. JONES, *Von Neumann algebras in topology and physics*

LÁSZLÓ LOVÁSZ, *Geometric algorithms and algorithmic geometry*

GEORGE LUSZTIG, *Character sheaves*

ANDREW J. MAJDA, *The interaction of nonlinear analysis and modern applied mathematics*

GREGORI A. MARGULIS, *Lie groups and ergodic theory*

RICHARD B. MELROSE, *Pseudodifferential operators, corners and singular limits*

SHIGEFUMI MORI, *Birational classification of algebraic threefolds*

YAKOV G. SINAI, *Hyperbolic billiards*

KAREN K. UHLENBECK, *Non-linear partial differential equations and topology*

ALEXANDER N. VARCHENKO, *Multidimensional hypergeometric functions and their appearance in conformal field theory, algebraic K-theory, algebraic geometry, etc.*

Section 1 – Mathematical Logic and Foundations

EHUD HRUSHOVSKI, *Categorical structures*

THEODORE A. SLAMAN, *Degree structures*

JOHN R. STEEL, *Iteration trees*

LOU VAN DEN DRIES, *The logic of local fields*

Section 2 – Algebra

JON F. CARLSON, *Cohomology and modules over group algebras*

ROSTISLAV I. GRIGORCHUK, *On the growth in group theory*

CRAIG HUNEKE, *Infinite integral extensions and Cohen-Macaulay rings*

ALEXANDER R. KEMER, *Identities of associate algebras*

PAUL ROBERTS, *Intersection theory and the homological conjectures in commutative algebra*

KLAUS W. ROGGENKAMP, *The isomorphism problem for integral group rings*

ROBERT W. THOMASON, *The local to global principle in algebraic K-theory*

EFIM I. ZELMANOV, *Restricted Burnside problem*

Section 3 – Number theory

HENRI GILLET, *The Riemann-Roch theorem in arithmetic geometry*

MARTIN NEIL HUXLEY, *Area, lattice points and exponential sums*

KAZUYA KATO, *Generalized class field theory*

V. A. KOLYVAGIN, *On the Mordell-Weil and Shafarevich-Tate groups of modular elliptic curves*

GÉRARD LAUMON, *Transformation de Fourier géometrique et formes automorphes*

YU. V. NESTERENKO, *Algebraic independence of values of analytic functions*

PETER SARNAK, *Analytic aspects of the theory of automorphic forms*

TETSUJI SHIODA, *Theory of Mordell-Weil lattices*

Section 4 – Geometry

ROBERT FRIEDMAN, *Algebraic surfaces and 4-manifolds*

KENJI FUKAYA, *Collapsing Riemannian manifolds and its application*

ETIENNE GHYS, *The circle at infinity of negatively curved surfaces*

KARSTEN GROVE, *Metric and topological measurements of manifolds*

HELMUT HOFER, *Symplectic invariants*

PETER BENEDICT KRONHEIMER, *Hyper-Kähler geometry and singularities in Yang-Mills moduli spaces*

DUSA MCDUFF, *New developments in symplectic geometry*

JOHN MILLSON, *Rational homotopy theory and deformation problems from algebraic geometry*

EUGENII I. SHUSTIN, *Geometry of discriminant and topology of algebraic curves*

JOSEF H. M. STEENBRINK, *Applications of Hodge theory to singularities*

TOSHIKAZU SUNADA, *Trace formulas in spectral geometry*

GANG TIAN, *Kähler-Einstein metrics on algebraic manifolds*

Section 5 – Topology

MARCEL BÖKSTEDT, *Algebraic K-theory of spaces and the Novikov conjecture*

FRANCIS BONAHON, *Low dimensional manifolds of negative curvature*

DAVID GABAI, *Foliations and the topology of 3-manifolds*

THOMAS G. GOODWILLIE, *The differential calculus of homotopy functors*

CAMERON M. GORDON, *Dehn surgery on knots*

KIYOSHI IGUSA, *Parametrized Morse theory and its applications*

LOWELL JONES, *Topological aspects of non-positively curved manifolds*

SHIGEYUKI MORITA, *Mapping class groups of surfaces and three dimensional manifolds*

HENRI MOSCOVICI, *Elliptic operators and invariants of non-simply connected manifolds*

VLADIMIR G. TURAEV, *State sum models in low-dimensional topology*

Section 6 – Algebraic Geometry

YUJIRO KAWAMATA, *Canonical singularities and minimal models of algebraic varieties*

JÁNOS KOLLÁR, *The structure of algebraic threefolds*

ROBERT LAZARSFELD, *Linear series on algebraic varieties*

MORIHIKO SAITO, *Mixed Hodge modules*

LESLIE D. SAPER, *L_2-cohomology of algebraic varieties*

CARLOS T. SIMPSON, *Non-abelian hodge theory*

PAUL VOJTA, *Arithmetic and Diophantine geometry*

Section 7 – Lie Groups and Representations

DAN BARBASCH, *Unipotent representations for real reductive groups*

GÜNTER HARDER, *Eisenstein cohomology of arithmetic groups and applications to arithmetic*

MASAKI KASHIWARA, *Crystalizing the q-analogue of enveloping algebras*

OLIVIER MATHIEU, *On the classification of graded simple Lie algebras*

TOSHIHIKO MATSUKI, *Orbits on flag manifolds*

COLETTE MOEGLIN, *Sur les formes automorphes de carré intégrable*

GOPAL PRASAD, *Semi-simple groups and arithmetic subgroups*

STEPHEN RALLIS, *L-functions and the oscillator representation*

Section 8 – Real and Complex Analysis

ERIC BEDFORD, *Iteration of polynomial automorphisms of C^2*

F. MICHAEL CHRIST, *Analysis on three-dimensional CR manifolds of finite type*

RONALD R. COIFMAN, *Operator analysis and numerical algorithms*

CURT MCMULLEN, *Rational maps and Kleinian groups*

TAKAFUMI MURAI, *Analytic capacity*

TAKEO OHSAWA, *Recent applications of L^2 estimates for the operator $\bar{\partial}$*

DAVID PREISS, *Measures and differentiability in Banach spaces*

KYOJI SAITO, *Teichmüller modular function and growth of discrete groups*

NESSIM SIBONY, *Function theory on weakly pseudo-convex domains*

NICHOLAS TH. VAROPOULOS, *Analysis and geometry on groups*

A. L. VOLBERG, *What are the asymptotically holomorphic functions?*

Section 9 – Operator Algebras and Functional Analysis

SCOTT W. BROWN, *Dual algebras*

JOACHIM CUNTZ, *K-theory and cyclic cohomology*

ADRIAN OCNEANU, *Quantum symmetry, classification of subfactors and quantum field theory*

MIHAI PIMSNER, *K-theory for groups acting on trees*

SORIN POPA, *Subfactors and classification in von Neumann algebras*

GEORGES SKANDALIS, *Operator algebras and the duality principle*

MICHEL TALAGRAND, *Some isoperimetric inequalities and their applications*

Section 10 – Probability Theory and Mathematical Statistics

MARTIN T. BARLOW, *Diffusions on fractals*

PERSI DIACONIS, *Applications of group representations in probability and statistics*

ROLAND L. DOBRUSHIN, *Large deviation of Gibbs fields*

RICHARD T. DURRETT, *Interacting particle systems: A pictorial introduction*

HILLEL FURSTENBERG, *Ergodic structures and Ramsey theory*

SHINICHI KOTANI, *Random Schrödinger operators*

SHIEGO KUSUOKA, *De Rham cohomology of Wiener-Riemannian manifolds*

LUCIEN LE CAM, *Some recent developments in the asymptotic theory of estimation*

STANISLAV A. MOLCHANOV, *Localization and intermittency – New results*

MARC YOR, *The laws of some Brownian functionals*

Section 11 – Partial Differential Equations

DEMETRIOS CHRISTODOULOU, *The stability of Minkowski spacetime in general relativity*

MATTHIAS GÜNTHER, *Free boundary problems for partial differential equations connected with magnetic fluids*

MITSURU IKAWA, *Scattering by obstacles*

GILLES LEBEAU, *Singularités des solutions d'equations d'ondes semilinéaires*

FENG HUA LIN, *Evolutions of liquid crystals and moving defects*

PIERRE SCHAPIRA, *Sheaf theory for partial differential equations*

MICHAEL STRUWE, *The evolution of harmonic maps*

KANEHISA TAKASAKI, *Integrable systems in gauge theory, hyper-Kähler geometry, and super KP hierarchy – symmetries and algebraic point of view*

LUC TARTAR, *H-measures and their applications*

MICHAEL E. TAYLOR, *Problems and progress in microlocal analysis*

Section 12 – Ordinary Differential Equations and Dynamical systems

CÉSAR CAMACHO, *Limit sets of foliations on complex projective spaces*

LENNART CARLESON, *The dynamics of non-uniformly hyperbolic systems in two variables*

JEAN ECALLE, *The acceleration operator and its application to differential equations*

JULIJ S. IL'YASHENKO, *Finiteness theorems for limit cycles*

ANATOLII I. NEISHTADT, *Review on the theory of averaging*

SHELDON E. NEWHOUSE, *Entropy in smooth dynamical systems*

S. MARY REES, *Combinatorial models in parameter spaces of rational maps*

JEAN-CHRISTOPHE YOCCOZ, *Optimal arithmetical conditions in small divisors theorems*

Section 13 – Mathematical Physics

RODNEY JAMES BAXTER, *Solvable models in statistical mechanics: Do we need elliptic functions?*

SERGIO DOPLICHER, *Algebras of local observables and quantum field theory*

JOEL FELDMAN, *Constructive field theory*

MICHIO JIMBO, *Solvable lattice models*

I. M. KRICHEVER, *The periodic problems for two-dimensional integrable systems*

ANTTI KUPIAINEN, *Renormalization group and random systems*

NICOLAI RESHETIKHIN, *Invariants of links and 3-manifolds connected with quantum groups*

GRAEME SEGAL, *Geometric aspects of quantum field theory*

ISRAEL M. SIGAL, *Quantum many-body problem*

AKIHIRO TSUCHIYA, *Conformal field theory*

STANISLAW L. WORONOWICZ, *Noncompact quantum groups*

A. B. ZAMOLODCHIKOV, *title to be announced*

Section 14 – Combinatorics

NOGA ALON, *Non-constructive proofs in combinatorics*

PETER J. CAMERON, *Infinite permutation groups in enumeration and model theory*

MASAO IRI, *Engineering point of view on applications of combinatorics*

ALEXANDER A. IVANOV, *Applications of group amalgams in classification of symmetric graphs*

VOJTECH RODL, *Some recent results in Ramsey theory*

ÉVA TARDOS, *Strongly polynomial and combinatorial algorithms in optimization*

CARSTEN THOMASSEN, *Graphs, random walks, and electrical networks*

Section 15 – Mathematical Aspects of Computer Science

LÁSZLÓ BABAI, *Computational complexity in finite groups*

LENORE BLUM, *A theory of computation and complexity over the real numbers*

A. L. CHISTOV, *title to be announced*

SHAFI GOLDWASSER, *The search for provably secure cryptosystems*

VALERY D. GOPPA, *Algebraic-geometric methods in computer science*

AVI WIGDERSON, *Communication complexity and Boolean circuit complexity*

Section 16 – Computational Methods

AMIRAM HARTEN, *Recent developments in shock-capturing schemes*

W. M. KAHAN, *Paradoxes in our concepts of numerical accuracy*

A. V. KARZANOV, *Multicommodity flow and related problems: Special duality theorems, solution fractionalities, efficient combinatorial algorithms*

ROBERT KRASNY, *Computational study of vortex sheet evolution*

MASATAKE MORI, *Development in the double exponential formulas for numerical integration*

JAMES RENEGAR, *Approximating solutions for algebraic formulae: Computational complexity and condition numbers*

Section 17 – Applications of Mathematics to the Sciences

PHILIP HOLMES, *Can dynamical systems approach turbulence?*

YVES MEYER, *Wavelets and applications*

MASAYASU MIMURA, *Pattern formation in reaction-diffusion systems*

Section 18 – History, Teaching and the Nature of Mathematics

ANNICK HORIUCHI, *Seki Takakazu (?-1708) and the development of mathematics in Japan during the Edo era (1600-1868)*

YURI I. MANIN, *Mathematics as metaphor*

HARUO MURAKAMI, *Teaching mathematics to students not majoring in mathematics – Present situation and future prospects*

ICMI Sessions

HIROSHI FUJITA, *Mathematical literacy and Japanese new mathematics curriculum*

MIGUEL DE GUZMÁN, *Games and puzzles and their role in the popularization of mathematics*

BERNARD HODGSON, *The ICMI studies: Some personal views*

YONG WOON KIM, *National mentality and mathematical education*

JACOBUS H. VAN LINT, *Structuring discrete mathematics*

THE BEAUTY AND COMPLEXITY OF THE MANDELBROT SET

University Edition

with John Hubbard

A Science Television Production

Providing an accessible introduction to the basics of fractals, this videotape presents an appealing balance of the theoretical and aesthetic aspects of the Mandelbrot set. Viewers will appreciate the clarity of exposition as John Hubbard uses a combination of lecture, boardwork, Macintosh computer demonstrations, and colorful computer-generated films and pictures to bring the concepts to life.

Part I focuses on iteration and Julia sets, while Part II addresses Mandelbrot sets. Part III examines a way of using the concept of electric field lines to understand these fractal sets. The concluding remarks round out the lecture by pointing to a philosophical framework that relate these sets to phenomena occurring in the natural world. Requiring only a background in calculus, this videotape will provide a useful tool in classrooms and would be an excellent addition to a videotape library.

1980 Mathematics Subject Classification: 58
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Symposium on Some Mathematical Questions in Biology

Neural Networks

Vancouver, Canada, August 2-3

The twenty-fourth annual Symposium on Some Mathematical Questions in Biology on *Neural networks* will be held on Thursday and Friday, August 2 – 3, 1990, during the Congress of the International Union for Pure and Applied Biophysics (IUPAB), July 29 – August 3, 1990. The symposium is sponsored by the American Mathematical Society, the Society for Industrial and Applied Mathematics (SIAM), and the Society for Mathematical Biology (SMB).

The AMS-SIAM-SMB Committee on Mathematics in the Life Sciences serves as the Organizing Committee for the symposium. The committee at the time this topic was selected consisted of Jack D. Cowan (organizer), Michael C. Mackey, Marc Mangel, Hans G. Othmer, Richard E. Plant (chairman), and John Rinzel.

The theme of the symposium is *Neural networks.* There will be two morning sessions, one on Thursday and one on Friday, August 2 and 3, each session including three one-hour lectures.

For further information, contact the Symposium Conference Coordinator, AMS, P.O. Box 6887, Providence, RI 02940 or by electronic mail: BAV@MATH.AMS.COM.

Applications for the Landahl Travel Awards from the SMB for graduate students to attend this meeting should have been submitted by May 25. See the **Funding Information** section (Landahl Travel Awards) of the April *Notices* for further details.

Program

Thursday, August 2, 9:30 a.m.

Chairman: Robert Miura, University of British Columbia

Neurodynamics. JACK D. COWAN, University of Chicago

Learning, networks, and approximation theory. T. A. POGGIO, Massachusetts Institute of Technology

Neural networks, information theory, and perception in animals and machines. RALPH LINSKER, IBM T. J. Watson Research Center

Friday, August 3, 9:30 a.m.

Chairman: John Rinzel, National Institutes of Health

Learning and generalization in multi-layered neural networks: A statistical analysis. D. RUMELHART, Stanford University

Growing and pruning neural networks: relation to statistical mechanics. ALAN LAPEDES, Los Alamos National Laboratory

Perspectives in computational neurobiology. TERRENCE J. SEJNOWSKI, Salk Institute

Positive Definite Unimodular Lattices with Trivial Automorphism Groups

Etsuko Bannai

(Memoirs of the AMS, Number 429)

In this book, the author proves that there exists a lattice with trivial automorphism group in every genus of positive definite unimodular **Z**-lattices of rank m (with $m \geq 43$ for the odd unimodular case and $m \geq 144$ for the even unimodular case). Siegel's mass formulas for lattices (for both orthogonal and hermitian cases) are used in the proof. In addition, the author shows that, for those positive definite unimodular **Z**-lattices in the given genus and of rank m, the ratio of the mass of classes with nontrivial automorphisms to the mass of all classes approaches 0 very rapidly as m increases. The book is intended for researchers and advanced graduate students in the areas of number theory and quadratic forms.

1980 Mathematics Subject Classification: 10
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Call For Topics For 1992 Conferences

Suggestions are invited from mathematicians, either singly or in groups, for topics of the various conferences that will be organized by the Society in 1992. The deadlines for receipt of these suggestions, as well as some relevant information about each of the conferences, are given below. An application form to be used when submitting suggested topic(s) for any of these conferences (except the Short Course Series) may be obtained by writing to the Meetings Department, American Mathematical Society, P.O. Box 6887, Providence, RI 02940, or telephoning 401-455-4146, or sending E-mail to MEET@MATH.AMS.COM.

Individuals willing to serve as organizers should be aware that the professional meetings staff in the Society's Providence office will provide full support and assistance before, during, and after each of these conferences. Organizers should also note that for all conferences, except Summer Research Conferences, it is required that the proceedings be published by the Society, and that proceedings of Summer Research Conferences are frequently published. A member of the Organizing Committee must be willing to serve as editor of the proceedings.

All suggestions must include (1) the names and affiliations of proposed members and the chairman of the Organizing Committee; (2) a one- to two-page description addressing the focus of the topic, including the importance and timeliness of the topic, and estimated attendance; (3) a list of the recent conferences in the same or closely related areas; (4) a tentative list of names and affiliations of the proposed principal speakers; and (5) a list of likely candidates who would be invited to participate and their current affiliations. Any suggestions as to sites and dates should be made as early as possible in order to allow adequate time for planning. However, proposers of conferences should know that, by action of the AMS Board of Trustees, the Meetings Department of the Society is responsible for the final selection of the site for each conference and for all negotiations with the host institution. Individuals submitting suggestions for the conferences listed below are requested to recommend sites or geographic areas which would assist the Meetings Department in their search for an appropriate site. In the case of Joint Summer Research Conferences in the Mathematical Sciences, a one-, two-, or three-week conference may be proposed.

1992 AMS Symposium in Pure Mathematics

The Symposium in Pure Mathematics has traditionally been conducted in the spring of even-numbered years in conjunction with a sectional meeting. The symposium can be held independently of a sectional meeting and serves to honor great accomplishments in mathematics. Proceedings are normally published by the Society as volumes in the series *Proceedings of Symposia in Pure Mathematics.*

Topics in recent years have been:

1984 – *Pseudodifferential operators and Fourier integral operators with applications to partial differential equations,* organized by FRANÇOIS TREVES of Rutgers University

1987 – *The mathematical heritage of Herman Weyl,* organized by R. O. WELLS, JR. of Rice University.

1989 – *Complex geometry and Lie theory,* organized by JAMES CARLSON and C. HERBERT CLEMENS of the University of Utah.

Deadline For Suggestions: September 1, 1990

1992 AMS Summer Institute

Summer Institutes are intended to provide an understandable presentation of the state of the art in an active field of research in pure mathematics and usually extend over a three-week period. Dates for a Summer Institute must not overlap those of the Society's summer meeting, which at the time of this printing have not yet been determined. There should be a period of at least one week between them. Proceedings are published by the Society as volumes in the series *Proceedings of Symposia in Pure Mathematics.*

Current and recent topics:

1988 – *Operator theory/Operator algebras and applications,* organized by WILLIAM B. ARVESON of the University of California, Berkeley, and RONALD G. DOUGLAS of the State University of New York at Stony Brook.

1989 – *Several complex variables and complex geometry,* organized by STEVEN G. KRANTZ of Washington University.

1990 – *Differential geometry,* organized by ROBERT E. GREENE of the University of California, Los Angeles, and SHING-TUNG YAU of Harvard University.

Deadline For Suggestions: September 1, 1990

1992 AMS-SIAM-SMB Symposium Some Mathematical Questions in Biology

This one-day symposium, sponsored jointly by the AMS, the Society for Industrial and Applied Mathematics (SIAM), and the Society for Mathematical Biology (SMB), is usually held in conjunction with the annual meeting of a biological society closely associated with the topic. Papers from the symposia are published by the AMS as volumes in the series *Lectures on Mathematics in the Life Sciences.*

Current and recent topics:

1987 – *Models in population biology*, organized by ALAN HASTINGS of the University of California, Davis.

1988 – *Dynamics of excitable media*, organized by HANS G. OTHMER of the University of Utah.

1989 – *Sex allocation and sex change: Experiments and models*, organized by MARC MANGEL of the University of California, Davis.

1990 – *Neural Networks,* organized by JACK D. COWAN of the University of Chicago.

Deadline For Suggestions: September 1, 1990

1992 AMS-SIAM Summer Seminar

The goal of the Summer Seminar, sponsored jointly by the AMS and the Society for Industrial and Applied Mathematics (SIAM), is to provide an environment and program in applied mathematics in which experts can exchange the latest ideas and newcomers can learn about the field. Proceedings are published by the AMS as volumes in the series *Lectures in Applied Mathematics.*

Current and recent topics:

1987 – *Computational Aspects of VLSI Design with an Emphasis on Semiconductor Device Simulation,* organized by RANDOLPH BANK of the University of California, San Diego.

1988 – *Computational solution of nonlinear systems of equations*, organized by EUGENE ALLGOWER of Colorado State University.

1989 – *The mathematics of random media*, organized by WERNER KOHLER of Virginia Polytechnic Institute and State University and BENJAMIN WHITE of Exxon Research & Engineering Company.

1990 – *Vortex dynamics and vortex methods*, organized by CLAUDE GREENGARD of IBM T. J. Watson Research Center and CHRISTOPHER R. ANDERSON of the University of California, Los Angeles.

Deadline For Suggestions: September 1, 1990

1992 AMS-IMS-SIAM Joint Summer Research Conferences in the Mathematical Sciences

These conferences, jointly sponsored by the AMS, the Institute for Mathematical Statistics (IMS), and the Society for Industrial and Applied Mathematics (SIAM), are similar in structure to those held at Oberwolfach and represent diverse areas of mathematical activity, with emphasis on areas currently especially active. Careful attention is paid to subjects in which there is important interdisciplinary activity at present. Topics for the seventh series of one-week conferences, being held in 1990, are: *Probability models and statistical analysis for ranking data*; *Inverse scattering on the line*; *Deformation theory of algebras and quantization with applications to physics*; *Strategies for sequential search and selection in real time*; *Schottky problems*; and *Logic, local fields, and subanalytic sets.*

If proceedings are published by the AMS, they appear as volumes in the series *Contemporary Mathematics.*

Deadline For Suggestions: February 1, 1991

Call for Topics for 1992 AMS Short Course Series

The AMS Short Courses consist of a series of introductory survey lectures and discussions which take place over a period of one-and-one-half days during the Joint Mathematics Meetings held in January and August each year. Each theme is a specific area of applied mathematics or mathematics used in the study of a specific subject or collection of problems in one of the physical, biological, or social sciences, technology, or business.

Current and recent topics:

Combinatorial games (August 1990), *Mathematical questions in robotics* (January 1990), *Cryptology and computational number theory* (August 1989), *Matrix theory and applications* (January 1989), *Chaos and fractals* (August 1988), *Computational Complexity Theory* (January 1988). Proceedings are published by the Society as volumes in the series *Proceedings of Symposia in Applied Mathematics*, with the approval of the Editorial Committee.

Deadline for Suggestions: Suggestions for the January 1992 course should be submitted by **July 1, 1990**; suggestions for the August 1992 course should be submitted by **December 1, 1990.**

Submit suggestions to: James W. Maxwell, AMS, P.O. Box 6248, Providence, RI 02940.

Coming Soon!

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e-MATH is a bulletin board service which allows mathematicians to communicate electronically with a central information source, the American Mathematical Society (AMS) offices, and with each other. The system consists of a dedicated computer facility and associated software supported and maintained by AMS staff members.

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Electronic Bulletin Boards: The ability to post and read research announcements in the form of problems, solutions, and remarks. Items of professional interest such as parts of the *Notices of the AMS*, meeting schedules and agenda, Tables of Contents for selected publications, and new publications of the AMS will also be posted. Subscribers will be notified of new contributions.

On-line Conferencing: The ability for small groups (e.g., nominating committees, editorial committees, standing committees, research groups) to conduct business electronically in private conferences, asynchronously.

Mathematically Oriented Databases: The ability to search for correspondence or electronic mail addresses in a database comprised of the Combined Membership List (CML) of members of the AMS, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics, by indexed fields such as field of research interest or location.

Software Libraries: The ability to post and download mathematically oriented public domain software and courseware. TEX software developed and supported by the AMS will be made available in this way. Each contribution will be described by an abstract and identify persons or organizations, if any, responsible for support. Contributions will be examined for their general appropriateness but are offered on an as-is basis. The AMS assumes no liability of any kind for software made available through e-MATH.

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Mathematical Sciences Meetings and Conferences

THIS SECTION contains announcements of meetings and conferences of interest to some segment of the mathematical public, including *ad hoc*, local, or regional meetings, and meetings or symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. (Information on meetings of the Society, and on meetings sponsored by the Society, will be found inside the front cover.)

AN ANNOUNCEMENT will be published in *Notices* if it contains a call for papers, and specifies the place, date, subject (when applicable), and the speakers; a second full announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in each issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

IN GENERAL, announcements of meetings and conferences held in North America carry only date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of *Notices*, care of the American Mathematical Society in Providence.

DEADLINES for entries in this section are listed on the inside front cover of each issue. In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence SIX MONTHS prior to the scheduled date of the meeting.

EFFECTIVE with the 1990 volume of *Notices*, the complete list of Mathematical Sciences Meetings and Conferences will be published only in the September issue. In all other issues, only meetings and conferences for the twelve-month period following the month of that issue will appear. As new information is received for meetings and conferences that will occur later than the twelve-month period, it will be announced at the end of the listing in the next possible issue. That information will not be repeated until the date of the meeting or conference falls within the twelve-month period.

1990. **IMACS International Workshop on Massively Parallel Methods in Computational Physics**, Boulder, Colorado. (Sep. 1989, p. 914)

1990. **IMACS Conference on Computer Aided Design**, Yugoslavia. (Sep. 1989, p. 914)

1990. **CWI-IMACS Symposia on Parallel Scientific Computing**, Amsterdam, The Netherlands. (Feb. 1990, p. 216)

1990. **Concentration Year on Stochastic Models, Statistical Methods, and Algorithms in Image Analysis**, Rome, Italy. (Apr. 1990, p. 491)

1990–1991. **Academic Year Devoted to Operator Theory and Complex Analysis**, Mittag-Leffler Institute, Djursholm, Sweden. (Dec. 1989, p. 1432)

July 1990

July 1990. **AMS Summer Research Institute on Differential Geometry**, University of California, Los Angeles, CA.

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 02940.

July 1990. **Two Week Computer Algebra Course at the Research Institute for Symbolic Computation**, Linz, Austria. (May/Jun. 1990, p. 605)

16–August 3. **Conference on "Enriching Discrete Mathematics Courses with Recent Developments"**, Univ. of Wyoming, Laramie, WY. (Apr. 1990, p. 495)

22–28. **Konvexgeometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

23–27. **CADE 10 - Tenth International Conference on Automated Deduction**, West Germany. (Feb. 1990, p. 223)

23–28. **Fourth International Congress on Computational and Applied Mathematics**, Leuven, Belgium. (Jan. 1990, p. 58)

23–August 4. **Third Workshop on Stochastic Analysis**, Silivri, Istanbul-Turkey. (Feb. 1990, p. 223)

24–August 2. **A Summer School and Conference on Proof Theory**, University of Leeds, Leeds, UK. (May/Jun. 1990, p. 606)

26–29. **International Conference on New Trends in Geometric Function Theory and Applications**, University of Madras, Madras, India. (Sep. 1989, p. 918)

29–August 4. **Mechanik Und Algebraische Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

30–August 4. **The Fourth International Conference on Fibonacci Numbers and their Applications**, Wake Forest University, Winston Salem, NC. (Nov. 1989, p. 1252)

31–August 2. **Dynamics of Numerics and the Numerics of Dynamics**, Bristol, England. (Nov. 1989, p. 1252)

August 1990

August 1990–May 1991. **Special Year in Real Algebraic Geometry and Quadratic Forms**, University of California, Berkeley, CA. (May/Jun. 1990, p. 607)

1–5. **Topology Conference**, University of Georgia, Athens, GA. (May/Jun. 1990, p. 607)

2–3. **AMS-SIAM-SMB Symposium on Some Mathematical Questions in Biology, Neural Networks**, Vancouver, Canada. (Mar. 1990, p. 330)

5–9. **From Topology to Computation:**

Unity and Diversity in the Mathematical Sciences (in Honor of Professor Stephen Smale's 60th Birthday), Berkeley, CA. (Jan. 1990, p. 58)

5–11. **Mathematical Methods in Tomography**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

5–11. **International Conference on Approximation Theory**, Hungary. (Oct. 1989, p. 1097)

6–7. **AMS Short Course on Combinatorial Games**, Columbus, Ohio.

INFORMATION: M. Foulkes, AMS, P.O. Box 6248, Providence, RI 02940.

6–9. **1990 Joint Statistical Meetings**, Anaheim, CA. (Mar. 1988, p. 466)

6–10. **Singularities**, Honolulu, Hawaii. (Feb. 1990, p. 223)

*6–10. **Workshop on Geometric Methods and Finiteness Properties for Arithmetic Groups and Related Topics**, Bielefeld, Federal Republic of Germany.

PROGRAM: The Sonderforschungsbereich 343 and the Fakultät für Mathematik will support a five day workshop. It will focus on geometric methods and finiteness properties for arithmetic groups and related topics. It will offer the opportunity to meet and to explore topics of common interest to people working on buildings, analogous complexes, arithmetic groups and finiteness properties. There will be lectures and there will be time reserved for discussions.
INFORMATION: H. Abels, Fakultät für Mathematik, Postfach 8640, 4800 Bielefeld, F.R. Germany.

8–11. **Joint Mathematics Meetings**, Ohio State University, Columbus, OH. (including the summer meetings of the AMS, AWM, MAA and PME). This is the 75th Anniversary of the MAA.

INFORMATION: H. Daly, AMS, P.O. Box 6248, Providence, RI 02940.

8–11. **The Fifth KIT Mathematics Workshop**, Korea Institute of Technology, Taejon, Korea. (Mar. 1990, p. 330)

11–14. **Crypto '90**, University of California, Santa Barbara, CA. (Apr. 1990, p. 495)

12–13. **Workshop on Using Technology to Enhance the Teaching and Learning of Calculus and Precalculus Mathematics**, The Ohio State University, Columbus, OH. (Mar. 1990, p. 330)

12–18. **Algebraische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

12–18. **Pre-Congress Topology Conference**, University of Hawaii, Honolulu, HI. (Feb. 1990, p. 223)

13–16. **Alaska Conference, Quo Vadis, Graph Theory?**, University of Alaska, Fairbanks, AK. (Oct. 1989, p. 1097)

13–17. **Fifth International Conference on Hadronic Mechanics and Nonpotential Interactions**, University of Northern Iowa, Cedar Falls, Iowa. (Jul./Aug. 1989, p. 768)

13–17. **Eleventh IFAC World Congress**, Tallin, USSR. (Sep. 1989, p. 918)

13–17. **Algebraic Geometry and Analytic Geometry**, Tokyo, Japan. (Sep. 1989, p. 919)

13–17. **1990 International Conference on Parallel Processing**, Pennsylvania State University, University Park, PA. (Dec. 1989, p. 1438)

13–17. **NSF/CBMS Conference on Random Number Generation and Quasi-Monte Carlo Methods**, Univ. of Alaska, Fairbanks, AK. (Mar. 1990, p. 331)

*13–17. **Third International Colloquium on Group Theory**, Debrechen, Hungary.

INFORMATION: E. Szabò, Kossuth Lajos Univ., Mathematical Institute, Debrechen, Pf. 12, H-4010 Hungary.

13–18. **Institute of Mathematical Statistics Fifty-third Annual Meeting(jointly with the Second World Congress of the Bernoulli Society)**, Uppsala, Sweden. (Sep. 1989, p. 919)

13–18. **Tsukuba International Conference on Representations of Algebras and Related Topics**, University of Tsukuba, Japan. (Nov. 1989, p. 1253)

14–18. **The Asian Mathematical Conference 1990**, Hong Kong, China. (Sep. 1989, p. 919)

14–18. **Harmonic Analysis, Sendai 1990**, Tohoku University, Sendai, Japan. (Feb. 1990, p. 223)

14–18. **Zeta Functions in Geometry**, Tokyo Institute of Technology, Tokyo, Japan. (Feb. 1990, p. 223)

15–19. **International Conference on Knot Theory & Related Topics**, Naniwa-Kaikan Hotel, Osaka City, Japan. (Please note change in location from Apr. 1989, p. 497)

15–19. **International Conference on Commutative Algebra and Combinatorics**, Nagoya University, Nagoya, Japan. (Feb. 1990, p. 224)

15–20. **Conference on Gaussian Random Fields (The Third Nagoya Lévy Seminar)**, Nagoya University, Nagoya, Japan. (Nov. 1989, p. 1253)

16–18. **SIGAL International Symposium on Algorithms**, Tokyo, Japan. (Oct. 1989, p. 1097)

16–19. **Current Topics in Operator Algebras**, Nara Ken-New Public Hall, Nara, Japan. (Feb. 1990, p. 224)

18–22. **The Second International Conference on Graph Theory**, Kanagawa, Japan. (Feb. 1990, p. 224)

19–20. **Inverse Problems in Engineering Sciences**, Osaka Institute of Technology, Osaka, Japan. (Feb. 1990, p. 224)

*19–24. **Third International Conference on the Teaching of Statistics**, Dunedin, New Zealand.

INFORMATION: ICOTS 3, Department of Mathematics and Statistics, University of Otago, P.O. Box 56, Dunedin, New Zealand.

19–25. **Mathematische Methoden Des VLSI-Entwurfs Und Des Distributed Computings**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

*19–25. **Anwendungen der Infinitesimalmathematik**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: S. Albeverio, Bochum; D. Laugwitz, Darmstadt; W.A.J. Luxemburg, Pasadena.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

20–24. **Second International Joint Conference of the ISSAC-90 and the AAECC-8**, Nihon University, Tokyo, Japan. (Feb. 1990, p. 224)

20–24. **International Conference on Combinatorics (ICC '90)**, Hefei, Anhui, China. (Apr. 1990, p. 495)

*20–24. **Bifurcation and Chaos: Analysis, Algorithms, Applications**, Würzburg, Federal Republic of Germany.

ORGANIZER: T. Küpper, Hannover; F. Schneider, Würzburg; R. Seydel, Würzburg; H. Troger, Wien.
INFORMATION: R. Seydel, Inst. für Angewandte Mathematik und Statis-

tik, Univ. Würzburg, Am Hubland, D-8700 Würzburg.

20–25. **Fifth Conference on Numerical Methods**, Miskolc, Hungary. (Jan. 1990, p. 59)

21–29. **The International Congress of Mathematicians 1990**, Kyoto, Japan. (Nov. 1988, p. 1389)

23–September 1. **Twenty-eigth International Symposium on Functional Equations**, Graz-Mariatrost, Austria. (Dec. 1989, p. 1438)

26–September 1. **Komplexe Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

27–31. **Eleventh Prague Conference on Information Theory, Statistical Decision Functions and Random Processes**, Praha, Czechoslovakia. (Jan. 1990, p. 59)

28–30. **IMACS European Simulation Meeting on Problem Solving by Simulation**, Esztergom, Hungary. (Mar. 1989, p. 316)

28–31. **Operations Research 1990, International Conference Operations Research**, Vienna, Austria. (Jul./Aug. 1989, p. 768)

29–31. **International Colloquium on Words, Languages, and Combinatorics**, Kyoto Sangyo University, Kyoto, Japan. (Feb. 1990, p. 224)

30–September 1. **International Symposium on the Semigroup Theory and its Related Fields**, Ritsumeikan University, Kyoto, Japan. (Feb. 1990, p. 224)

30–September 2. **International Symposium on Functional Differential Equations and Related Topics**, Kyoto Shigaku Kaikan (YOUANDI), Kyoto, Japan. (Feb. 1990, p. 224)

30–September 4. **International Conference on Potential Theory**, Nagoya, Japan. (May/Jun. 1989, p. 602)

30–September 4. **International Symposium on Computational Mathematics**, Matsuyama, Japan. (Feb. 1990, p. 224)

31–September 1. **Tokyo History of Mathematics Symposium 1990**, University of Tokyo, Tokyo, Japan. (Feb. 1990, p. 224)

31–September 2. **Conference on Representation Theories of Lie Groups and Lie Algebras**, Lake-Kawaguchi, Yamanashi, Japan. (Feb. 1990, p. 224)

31–September 4. **International Symposium on Functional Analysis and Related Topics**, Sapporo, Japan. (Feb. 1990, p. 225)

31–September 4. **General Topology and Geometric Topology Symposium**, University of Tsukuba, Japan. (Feb. 1990, p. 225)

September 1990

September/October 1990. **IMACS-GAMM Conference on Computer Arithmetic, Scientific Computation and Mathematical Modelling**, Bulgaria. (Sep. 1989, p. 919)

IMACS Symposium on Modelling and Simulation of Electrical Machines, ENSEM - Nancy, France. (May/Jun. 1989, p. 602)

2–7. **Twelfth International Conference on Nonlinear Oscillations**, Cracow, Poland. (Sep. 1989, p. 919)

2–7. **International Conference on Integral Equations and Boundary Value Problems**, Yantai University, Shandong, People's Republic of China. (Nov. 1989, p. 1253)

2–8. **Topologie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 497)

3–6. **Fourth Asian Logic Conference**, Tokyo, Japan. (Mar. 1989, p. 316)

3–7. **IMACS Symposium on Intelligent Models in Systems Simulation**, Brussels, Belgium. (Mar. 1989, p. 316)

3–7. **Representation des Groupes et Analyse Complexe**, Marseille, France. (Jul./Aug. 1989, p. 768)

3–7. **International Conference on Dynamical Systems and Related Topics**, Nagoya University, Nagoya, Japan. (Feb. 1990, p. 225)

*3–7. **Third International Symposium on Algebra and Number Theory (in honour of the 80th birthday of C. Arf)**, Silivri, Istanbul.

INFORMATION: C. Koc, A. Topuzoglu, Dept. of Math., Middle East Technical University, 06531 Ankara-Turkey; email: dogam@trmetu.bitnet.

3–8. **Physical Interpretations of Relativity Theory**, Imperial College, London, England. (Mar. 1990, p. 331)

*3–8. **Stabilite Hydrodynamique Nonlineaire et Transition**, Nice, France.

INFORMATION: G. Jooss, Univ. de Nice, Labo. de math., Parc Valrose, F-06034 Nice.

8–12. **Neuronet-90: IMACS International Symposium on Neural Nets and Neural Computers**, Prague, Czechoslovakia. (Please note change from May/Jun. 1989, p. 602)

9–15. **Surgery and L-Theory**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

*9–21. **Computer Algorithms for Solving Linear Algebraic Systems: The State of the Art**, Il Ciocco, Italy.

INFORMATION: E. Spedicato, Istituto Universitario, Dipartimento di Matimatica, Via Salvecchio 19, 24100 Bergamo, Italy.

9–22. **Computer Algorithms for Solving Linear Algebraic Equations: The State of the Art**, Il Ciocco, Castelvecchio Pascoli, Tuscany, Italy. (May/Jun. 1990, p. 608)

10–12. **Second International Workshop on Advances in Robot Kinematics**, Linz, Austria. (Mar. 1990, p. 332)

10–14. **Mathematiker-Kongress**, Dresden, German Democratic Republic. (Jul./Aug. 1989, p. 769)

10–14. **Greco Calcul Formel**, Marseille, France. (Jan. 1990, p. 60)

10–14. **Real Analysis and Measure Theory**, Capri, Italy. (Mar. 1990, p. 332)

10–October 5. **School on Qualitative Aspects and Applications of Nonlinear Evolution Equations**, International Centre for Theoretical Physics, Trieste, Italy. (May/Jun. 1989, p. 602)

13–18. **The Marshall Hall 80th Birthday Conference on Coding Theory, Design Theory and Group Theory**, University of Vermont, Burlington, VT. (May/Jun. 1990, p. 608)

16–22. **Ankündigung der Jahrestagung 1990**, Universität Bremen, Bremen, W. Germany. (May/Jun. 1990, p. 609)

16–22. **Risikotheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

*16–22. **Algebraic Methods in Computing Science**, University College of Swansea, Swansea, Wales.

PURPOSE: The objectives are (i) to educate research students, and university and industrial scientists, in mathematical theories to an advanced

level; and (ii) to introduce many current theoretical and applied research problems involving algebraic methods.
PROGRAM: The basic courses will be as follows: J.V. Tucker, Designing algebras; J.A Goguen, Algebraic methods and theorem proving; H. Simmons, Equations and horn clauses: logic and model theory; J. Meseguer, Initial model semantics; J.W. Klop, Term rewriting; J. Baeten, Process algebra.
INFORMATION: B.C. Thompson, Computer Science Division, Dept. of Mathematics and Computer Science, Univ. College of Swansea, Swansea SA2 8PP, United Kingdom (email: csben@uk.ac.swan.pyr).

17–21. **Atelier International de Theorie des Ensembles**, Marseille, France. (Jan. 1990, p. 60)

17–22. **DMV-Jahrestagung 1990**, Bremen, Federal Republic of Germany. (Jul./Aug. 1989, p. 769)

19–21. **Third IMACS International Conference on Modelling and Simulation of Electrical Machines and Static Converters**, ENSEM - Nancy, France. (May/Jun. 1990, p. 609)

23–29. **Random Graphs and Combinatorical Structures**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

24–28. **Structure Galoisienne Arithmetique**, Marseille, France. (Jan. 1990, p. 60)

24–28. **IMACS-GAMM International Symposium on Computer Arithmetic, Scientific Computation and Mathematical Modelling - SCAN 1990**, Albena (near Varna), Bulgaria. (Feb. 1990, p. 225)

24–28. **International Symposium on Structures in Mathematical Theories**, San Sebastian, Espagna. (May/Jun. 1990, p. 609)

24–29. **Mathematical Modelling of Industrial Processes**, Tecnopolis, Bari. (Feb. 1990, p. 225)

24–30. **Ibero-American Conference**, Seville, Spain. (Apr. 1990, p. 497)

25–29. **International Symposium on Structures in Mathematical Theories**, San Sebastián, Spain. (Apr. 1990, p. 497)

27–29. **Topology and Geometry of Manifolds**, Bologna, Italy. (May/Jun. 1990, p. 609)

28–29. **Linear Algebra and its Applications**, Miami University, Oxford, OH. (Apr. 1990, p. 497)

30–October 6. **Diophantische Approximationen**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

October 1990

* 1–4. **Third European Conference on Multigrid Methods**, Bonn, Federal Republic of Germany.

INFORMATION: Conference Secretariat, C. Harms, GMD, P.O. Box 1240, D-5205 Sankt Augustin 1.

1–5. **Organisations et Theorie des Jeux**, Marseille, France. (Jan. 1990, p. 60)

1–5. **Third Joint Europe/U.S. Short Course in Hypersonics**, RWTH Aachen Univ. of Technology, Federal Republic of Germany. (Mar. 1990, p. 332)

* 1–5. **Methodes D'Elements Finis Mixtes**, Roquencourt, France.

CHAIRMAN: J.E. Roberts, Roquencourt
INFORMATION: INRIA-Service des Relations Extérieures Bureau Cours et Journées, Domaine de Voluceau, B.P. 105, F-78153 Le Chesnay Cedex.

5–6. **Math-History Conference**, LaCrosse, WI. (Jan. 1990, p. 60)

5–7. **Workshop on Partial Differential Equations**, Cornell Univ., Ithaca, NY. (Mar. 1990, p. 332)

* 5–8. **Second Annual SUNYA Conference on Topology and Group Theory**, State University of New York at Albany.

PROGRAM: This conference will be held at the same facility as the 1989 conference and will again focus on low dimensional topology and combinatorial group theory. There will be hour lectures by the eight main speakers and a (noncompeting) program of shorter talks. Deadline for registration is September 14, 1990.
INVITED SPEAKERS: G. Baumslag, M. Bestvina, M. Culler, J. Howie, M. Lustig, J. Morgan, J. Stallings, K. Vogtmann.
INFORMATION: T. Turner, Department of Mathematics and Statistics, State University of New York at Albany, Albany, NY 12222; Bitnet: et968@albvms; 518-442-4610.

7–13. **Arbeitsgemeinschaft Mit Aktuellem Thema**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

8–12. **Congres Franco-Sovietique de Programmation Mathematique**, Marseille, France. (Jan. 1990, p. 60)

14–20. **Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

15–19. **Modeles pour L'Analyse des Donnees Multidimensionnelles**, Marseille, France. (Jan. 1990, p. 60)

15–19. **Tercer Congreso Nacional de Matemáticas**, San José, Costa Rica. (Feb. 1990, p. 225)

18–21. **Sixteenth Annual Convention of the American Mathematical Association of Two-Year Colleges**, Dallas, TX. (May/Jun. 1990, p. 609)

* 19. **International Meeting on Nonlinear Dynamics in Mathematics & Science**, University of Massachusetts at Amherst.

PURPOSE: A chance to learn all about the field of nonlinear dynamics by having research lectures from international experts from U.S.S.R., England, Japan, and the U.S.
INVITED SPEAKERS: England: J.T. Stuart, J. Toland, L.E. Fraenkel; U.S.S.R.: V.I. Judovitch, O.A. Ladyhenskaya, A. Dubroischin; Japan: H. Matano; U.S.A.: H. McKean, A. Polyakov, R. Coifman, C. Jones, G. Knightly, C. Foias, R. Devaney.
INFORMATION: Center for Applied Mathematics, University of Massachusetts, Amherst, MA 01003, Attn: C. Boron, Coordinator; 413-545-0267.

19–20. **Nineteenth Midwest Conference on Differential and Integral Equations**, Univ. of Missouri-Rolla, Rolla, MO. (Apr. 1990, p. 498)

19–20. **Twelfth Midwest Probability Colloquium**, Northwestern University, Evanston, IL. (May/Jun. 1990, p. 610)

* 19–20. **1990 Mathematical Sciences Department Chairs Colloquium**, Arlington, VA.

PROGRAM: The theme of the 1990 colloquium is "Departmental Outreach." The program is designed to provide information chairs may use to foster departmental interaction with various constituent groups and external agencies. The program includes: a report by the Committee on the Mathematical Sciences in the Year 2000, panels on women and minorities in mathematics, and statistics in mathematics departments.

INFORMATION: Board on Mathematical Sciences, National Research Council, 2101 Constitution Avenue, N.W., Room NAS 312, Washington, DC 20418.

20–21. **Eastern Section**, University of Massachusetts at Amherst, Amherst, MA.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

21–27. **Mathematische Methoden In Der Robotik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

21–27. **Arithmetik der Körper**, Oberwolfach, Federal Republic of Germany. (Oct. 1989, p. 1098)

21–27. **International Functional Analysis Meeting on the Occasion of the Sixtieth Birthday of Professor M. Valdivia**, Peñiscola, Spain. (May/Jun. 1990, p. 610)

*21–27. **Algebraic and Combinatorial Problems in Multivariate Approximation Theory**, Oberwolfach, Federal Republic of Germany.

CHAIRMAN: W. Dahmen, Berlin; A. Dress, Bielefeld.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*22–24. **Thirty-first Annual Foundations of Computer Science**, St. Louis, MO.

INFORMATION: C. Papdimitriou, Dept. of Computer Science, Univ. of California, San Diego, La Jolla, CA 92093; 619-534-2086.

22–25. **Fifth Jerusalem Conference on Information Technology (JCIT-5)**, Jerusalem, Israel. (Jan. 1990, p. 60)

*22–26. **Journées de Probabilités**, Marseille, France.

ORGANIZER: J. Azéma, Paris; M. Yor, Paris.
INFORMATION: A. Zeller-Meier, CIRM, Luminy, Case 916, F-13288 Marseille Cedex 9.

*24–26. **Fifth Annual Conference of the Midwest College Learning Center Association - Breaking Barriers to Learning**, Milwaukee, WI.

PROGRAM: Keynote speakers - S. Tobias, Math Anxiety; M. Alvarez, Thinking Visually.
INFORMATION: J. Dvorak, MCLCA Conference Chair, UW-Milwaukee DLSEO P.O. Box 413, Milwaukee, WI 53201; 414-229-5672.

26–27. **Statistical Mechanics at the 45th Parallel: Fourth Annual Meeting**, Université de Montréal, Canada. (Feb. 1990, p. 226)

26–28. **Twenty-first U.S.L. Mathematics Conference (Algebra)**, University of Southwestern Louisianna, Lafayette, LA. (May/Jun. 1990, p. 610)

*28–November 1. **North American Conference on Logic Programming 1990 (NACLP '90)**, Austin, TX.

INFORMATION: C. Zaniolo, 3500 W. Balcones Center Dr., Austin, TX 78759; 512-338-3442.

28–November 3. **Mathematical Economics**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

29–November 2. **Trieste Conference on Integrable Systems**, Trieste, Italy. (Jan. 1990, p. 61)

29–November 2. **Algorithme Parallele et Architectures Nouvelles**, Marseille, France. (Jan. 1990, p. 61)

29–November 2. **The International Conference "D-Modules and Microlocal Geometry"**, Lisbon, Portugal. (Mar. 1990, p. 333)

29–November 16. **Workshop on Mathematical Ecology**, Trieste, Italy. (Jan. 1990, p. 61)

31–November 3. **Latinamerican Seminar on Applications of Mathematics and Computer Science to Biology**, La Habana, Cuba. (Feb. 1990, p. 226)

November 1990

2–3. **Central Section Meeting of the AMS**, University of North Texas, Denton, TX.

INFORMATION: W. Drady, AMS, P.O. Box 6248, Providence, RI 02940.

4–10. **Wahrscheinlichkeitsmaße auf Gruppen**, Oberwolfach, Federal Republic of Germany. (Oct. 1989, p. 1098)

*5–7. **Mathematiques Informatique**, Marseille, France.

ORGANIZER: J. M. Boe, Montpellier.
INFORMATION: A. Zeller-Meier, CIRM, Luminy, Case 916, F-13288 Marseille Cedex 9.

*5–8. **Second SIAM Confernce on Linear Algebra in Signals, Systems & Controls**, San Francisco, CA. (Please note date change from Sep. 1989, p. 920)

6–7. **1990 ACM Conference on Critical Issues**, Arlington, VA. (Apr. 1990, p. 498)

9–11. **Third Annual Conference on Technology in Collegiate Mathematics**, The Ohio State Univ., Columbus, OH. (Mar. 1990, p. 333)

10. **Differential Geometry Day**, Eastern Illinois University, Charleston, IL. (Apr. 1990, p. 498)

10–11. **Far Western Section**, University of California, Irvine, CA.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

12–16. **Supercomputing '90**, New York, NY. (Sep. 1989, p. 920)

12–16. **Workshop on Representations of Reductive Groups over Finite Fields**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1990, p. 61)

*12–16. **Supercomputing '90**, New York, NY.

INFORMATION: J.L. Martin, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY 10598; 914-945-3285.

16–17. **Tenth Annual Southeastern-Atlantic Regional Conference on Differential Equations**, Virginia Polytechnic Institute and State University, Blacksburg, VA. (May/Jun. 1990, p. 610)

18–24. **Komplexitätstheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

19–22. **Huygens' Principle 1690-1990, Theory and Applications**, Scheveningen, The Hague, The Netherlands. (May/Jun. 1990, p. 610)

*21–23. **Colloque Franco-Belge de Statistique**, Marseille, France.

ORGANIZER: C. Deniau, Marseille.
INFORMATION: A. Zeller-Meier, CIRM, Luminy, Case 916, F-13288 Marseille Cedex 9.

25–28. **Mathematics and its Applications**, University of Bahrain, State of Bahrain. (May/Jun. 1990, p. 610)

25–December 1. **Stochastische Approximation Und Optimierungsprobleme In Der Statistik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

25–December 1. **Lineare Modelle und Multivariate Statistische Verfahren**, Oberwolfach, Federal Republic of Germany. (Jul./Aug. 1989, p. 769)

* 26–30. **Seminaire Sud-Rhodanien de Geometrie Differentielle**, Marseille, France.

ORGANIZER: L. Niglio, Avignon.
INFORMATION: A. Zeller-Meier, CIRM, Luminy, Case 916, F-13288 Marseille Cedex 9.

December 1990

2–8. **Multigrid Methods**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

3–5. **First International Symposium on Uncertainty and Analysis: Fuzzy Reasoning, Probabilistic Methods and Risk Management**, College Park, Maryland. (Oct. 1989, p. 1098)

3–7. **Sixteenth Australasian Conference on Combinatorial Mathematics and Combinatorial Computing**, Palmerston North, New Zealand. (Feb. 1990, p. 226)

3–7. **SINO-JAPANESE Joint Seminar on Nonlinear PDEs with Emphasis on Reaction-Diffusion Aspects.**, Taipei, Taiwan. (Jan. 1990, p. 61)

3–7. **Workshop on General Group Representation Theory**, Mathematical Sciences Research Institute, Berkeley, CA. (Jan. 1990, p. 61)

9–15. **Allgemeine Ungleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

* 11–12. **Integral Valued Polynomials Encounter**, CIRM, Marseille, France. (Please note additional Invited Speakers from May/Jun. 1990, p. 611)

INVITED SPEAKERS: J. Brewer, Florida; M. Fontana, Rome; D. Lantz, Hamilton; A. Micali, Montpellier.

11–13. **Third Joint IFSA-EC and EURO-WG Workshop on Fuzzy Sets**, Visegrád, Hungary. (May/Jun. 1990, p. 611)

15–19. **Curves and Surfaces: An Algorithmic Viewpoint**, Kent State Univ., Kent, OH. (Apr. 1990, p. 499)

16–22. **Mathematische Logik**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

17–21. **Non-linear Dispersive Wave Systems**, Univ. of Central Florida, Orlando, FL. (Apr. 1990, p. 499)

25–January 1. **Lineare Modelle Und Multivariate Statistische Verfahren**, Oberwolfach, Federal Republic of Germany. (Apr. 1989, p. 498)

* 27–31. **Holiday Symposium on Recent Developments in Homotopy Theory**, New Mexico State Univ., Las Cruces, NM.

PROGRAM: This year's symposium is focused on recent developments in homotopy theory. There will be a series of ten lectures, two each day, by D.C. Ravenel of the Univ. of Rochester. There will be additional sessions for contributed papers, research ideas, and discussion. Some support may be available for a limited number of participants.
INFORMATION: R.J. Wisner, Homotopy Theory Symposium, Dept. of Mathematical Sciences, New Mexico State Univ., Box 30001, Las Cruces, NM 88003-0001; 505-646-3901.

* 1991. **IMACS Symposium on Parallel and Distributed Computing in Engineering Systems**, Athens, Greece.

INFORMATION: S. Tzafestas, National Technical University of Athens, Division of Computer Science, Dept. of Electrical Engineering, 157 73 Zographou, Athens, Greece.

Spring 1991. **IMACS International Symposium on Iterative Methods in Linear Algebra**, Brussels Free Univ., Brussels, Belgium. (Mar. 1990, p. 334)

January 1991

6–12. **Automorphe Formen und Anwendungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

* 7–9. **SIAM Workshop on Automatic Differentiation of Algorithms: Theory, Implementation, and Application**, Breckenridge, CO.

ORGANIZER: A. Griewank, Argonne Nat'l. Lab.
INFORMATION: SIAM Conference Coordinator, Dept. CC0590, 3600 University City Science Ctr., Philadelphia, PA 19104-2688; 215-382-9800; Fax 215-386-7999; email: siamconfs@wharton.upenn.edu.

7–10. **Sixth Caribbean Conference in Combinatorics and Computing**, University of the West Indies, St. Augustine, Trinidad. (Jan. 1990, p. 61)

13–19. **Combinatorical Optimization**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

14–15. **AMS Short Course on "Probabilistic Combinatorics and its Applications"**, San Francisco, CA.

INFORMATION: D. Plante, AMS, P.O. Box 6248, Providence, RI 02940.

16–19. **Joint Mathematics Meetings**, San Francisco, CA. (including the annual meetings of the AMS, AWM, MAA, and NAM)

INFORMATION: H. Daly, AMS, P.O. Box 6248, Providence, RI 02940.

20–26. **Spektraltheorie Singulärer Gewöhnlicher Differentialoperatoren**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

27–February 2. **Harmonische Analyse und Darstellungstheorie Topologischer Gruppen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

* 28–30. **Second ACM-SIAM Symposium on Discrete Algorithms**, San Francisco, CA.

PURPOSE: This conference is designed for computer scientists, engineers, and mathematicians interested in the use, design and analysis of algorithms, with special emphasis on questions of efficiency.
ORGANIZER: A. Aggarwal, IBM T.J. Watson Research Ctr.
INVITED SPEAKERS: R.L. Graham, AT&T Bell Labs.; E.S. Lander, Whitehead Institute for Biomedical Research and Harvard Univ.; L. Lovasz, Lorand Eotvos Univ., Hungary and Princeton Univ.
CALL FOR PAPERS: Papers will be selected for presentation based on extended abstracts. Authors wishing to submit a paper should send 11 copies of an extended abstract (not a full paper) to SIAM by July 30, 1990.
INFORMATION: SIAM Conference Coordinator, Dept. CC0590, 3600 University City Science Ctr.,Philadelphia, PA 19104-2688; 215-382-9800; Fax

215-386-7999; email: siamconfs@wharton.upenn.edu.

February 1991

3–9. **Konstruktive Methoden in der Komplexen Analysis**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

10–16. **Endlichdimensionale Lie-Algebren**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

10–16. **Affine Differentialgeometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 499)

* 17–23. **Experimentelle, Insbesondere Computergraphische Methoden in der Mathematik**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: H.-O. Peitgen, Bremen; U. Pinkall, Berlin.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

* 17–23. **Krein Spaces and Applications to Differential Operators**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: L. de Branges, West Lafayette; H. Langer, Regensburg; R. Mennicken, Regensburg.

24–March 2. **Medical Statistics: Statistical Models for Longitudinal Data**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

25–March 1. **IEEE Computer Society COMPCON Spring '91**, San Francisco, CA. (Jan. 1990, p. 62)

March 1991

3–9. **Partielle Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

5–7. **Association for Computing Machinery 1991 Computer Science Conference**, San Antonio Convention Center, San Antonio, TX. (May/Jun. 1990, p. 611)

7–8. **Twenty-second ACM SIGCSE Technical Symposium on Education in the Computing Sciences**, San Antonio, TX. (May/Jun. 1990, p.612)

7–10. **International Conference on Differential Equations**, Cadi Ayyad University, Marrakech, Morocco. (May/Jun. 1990, p.612)

10–16. **Mathematische Stochastik**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

* 11–15. **NSF-CBMS Regional Research Conference on Nonlinear Dispersive Wave Systems**, University of Central Florida, Orlando, FL. (Please note changes from May/Jun. 1990, p. 612)

PROGRAM: Professor Benjamin's lectures will cover a broad range of topics connected with nonlinear waves propagation in continuum mechanics. A partial outline of the ten, one-hour lectures he will deliver is as follows: examples of nonlinear dispersive waves, exact and approximate representation of physical systems, water waves, internal waves, vortex motions; Hamiltonian structure, symmetries and conservation laws, practical interpretations; canonical derivation of approximate equations, long-wave models, envelope equations; variational principles for group-invariant solutions, prospects for variational existence theories; stability and instability of wave motions; effects of dispersion on otherwise discontinuous solutions of nonlinear wave equations; theory of vortex-breakdown phenomenon, relation between axisymmetric and symmetry-breaking types; review of outstanding problems. Additional invited lectures by other leading experts will also be featured, and ample opportunity is planned for informal discussion as well.

13–15. **IMACS Workshop on Decision Support Systems and Qualitative Reasoning**, LAAS-Toulouse, France. (May/Jun. 1990, p. 612)

16–17. **Central Section**, Indiana University, South Bend, IN.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

17–23. **Elementare und Analytische Zahlentheorie**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

17–24. **Sixth International Conference on Geometry**, University of Haifa, Israel. (May/Jun. 1990, p. 612)

21–23. **Sixth S.E.A. Meeting, Southeastern Approximation Theorists Annual Meeting**, Memphis State Univ., Memphis, TN. (Mar. 1990, p. 334)

22–23. **Southeastern Section**, University of South Florida, Tampa, FL.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

22–24. **Fifth SIAM Conference on Parallel Processing for Scientific Computing**, Houston, TX. (Mar. 1990, p. 334)

24–30. **Gewöhnliche Differentialgleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

* 25–27. **Fifth SIAM Conference on Parallel Processing for Scientific Computing**, Houston, TX.

ORGANIZER: D. Sorensen, Rice Univ.
INFORMATION: SIAM Conference Coordinator, Dept. CC0590, 3600 University City Science Ctr.,Philadelphia, PA 19104-2688; 215-382-9800; Fax 215-386-7999; email: siamconfs@wharton.upenn.edu.

* 25–28. **International Conference on Mathematical Linguistics - ICML '91**, Barcelona, Spain.

PROGRAM: ICML intends to become an open forum for the presentation and discussion of current research on mathematical models of natural language. ICML '91 aims to show the actual state-of-the-art in the different fields of the discipline. The language of the Congress is English.
CALL FOR PAPERS: Papers for a presentation in 30 minutes are accepted. Authors must send a single copy of an abstract (1 page). Abstract submission deadline: September 6, 1990. Notification deadline of acceptance: September 20, 1990. Final text deadline: December 23, 1990.
INFORMATION: C.M. Vide, Univ. de Barcelona, Facultat de Filogia, Secció de Linguística General, Gran Via de les Corts Catalanes, 585, 08007 Barcelona, Spain; Fax: 93 - 302.59.47 (from Spain); 34-3-302.59.47 (from another country).

31–April 6. **Arbeitsgemeinschaft mit Aktuellum Thema**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

April 1991

2–4. **IMACS International Symposium on Iterative Methods in Linear Alge-**

bra, Brussels Free Universities, Belgium. (May/Jun. 1990, p. 612)

7–13. **Algebraische Gruppen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

8–12. **Seventh International Conference on Data Engineering**, Kobe, Japan. (Apr. 1990, p. 500)

8–12. **NASECODE VII, The Seventh International Conference on the Numerical Analysis of Semiconductor Devices and Integrated Circuits**, Copper Mountain, Colorado. (May/Jun. 1990, p. 612)

* 10–12. **Fourth International Conference on Rewriting Techniques and Applications (RTA-91)**, Como, Italy.

SPONSORS: State University of Milan in cooperation with the European Association for Theoretical Computer Science, the IEEE Technical Committee on Mathematical Foundations of Computer Science, and the Association for Computing Machinery-SIGACT and SIGART.
CONFERENCE TOPICS: Term rewriting systems, conditional and typed rewriting, completion procedures, unification and matching algorithms, algebraic specification, rewrite-based functional and equational programming languages, rewrite-based theorem proving, graph rewriting and graph grammars, higher-order systems, rewriting techniques in symbolic and algebraic computation, Thue systems, studies of combinatorial structures using rewriting techniques, combinatorial rewriting in computer science, mathematics, and other areas of application.
CALL FOR PAPERS: Papers presenting original research on rewriting techniques and applications are being sought. Original research papers are solicited. All submissions should be clearly written in English and include references and comparisons with related work (where appropriate). Each submission should include ten (10) copies of an extended abstract or a full draft paper of at most 4,000 words (e.g., approximately 10 - 15 double spaced pages).
INFORMATION: R.V. Book, RTA-91, Theoretische Informatik, Institut für Informatik, Univ. Würzburg, Am Hubland, D-8700 Würzburg, West Germany.

14–20. **Brauer Groups and Representation Theory of Finite Groups**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 500)

* 21–27. **Numerical Linear Algebra**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: G.H. Golub, Stanford; W. Niethammer, Karlsruhe; R.S. Varga, Kent.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

* 23–26. **Mathematical and Numerical Aspects of Wave Propagation Phenomena**, Strasbourg, France.

CONFERENCE TOPICS: Waves in homogeneous, heterogeneous, layered or random media; Guided waves, surface waves, scattering, resonances; Inverse problems, homogenization, control theory; Ray methods, paraxial methods, asymptotic analysis, absorbing boundary conditions; FMD, FEM; Spectral methods, integral equations, multigrid methods, domain decomposition; Vector and parallel processing.
INFORMATION: INRIA, Service des Relations Exterieures, Domaine de Voluceau - BP 105 - Rocquencourt, 78153 Le Chesnay Cedex, France.

28–May 4. **Deductive Systems**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

May 1991

May/June 1991. **IMACS Workshop on Decision Support Systems and Qualitative Reasoning**, Toulouse, France. (Mar. 1990, p. 334)

* 5–11. **Darstellungstheorie Endlich-Dimensionaler Algebren**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: V. Dlab, Ottawa; C.M. Ringel, Bielefeld.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

* 6–8. **Fifth SIAM International Symposium on Domain Decomposition Methods for Partial Differential Equations**, Norfolk, VA.

ORGANIZER: R.G. Voigt, ICASE-NASA Langley Research Ctr.
INFORMATION: SIAM Conference Coordinator, Dept. CC0590, 3600 University City Science Ctr., Philadelphia, PA 19104-2688; 215-382-9800; Fax 215-386-7999; email: siamconfs@wharton.upenn.edu.

7–10. **IMACS Symposium on Modelling and Simulation of Control Systems**, Casablanca, Morocco. (Mar. 1990, p. 334)

* 7–14. **Singapore Number Theory Workshop**, National Univ. of Singapore, Kent Ridge, Singapore.

ORGANIZING COMMITTEE: T.A. Peng (Chair), S.L. Ma (Secretary), T.S. Chew (Treasurer), K.H. Leung (Programme), R.K.S. Poh (Accommodation).
INVITED SPEAKERS AND TOPICS: B.H. Gross (Harvard Univ.), Elliptic curves and modular forms; W.M. Schmidt (Univ. of Colorado), Diophantine equations; J.-P. Serre (Collège de France), Sieves.
INFORMATION: S.L. Ma, Secretary, Singapore Number Theory Workshop, Dept. of Math., Nat'l. Univ. of Singapore, Kent Ridge, Singapore 0511, Republic of Singapore; email: matmasl@nusvm.bitnet.

12–18. **Nichtlineare Evolutionsgleichungen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

13–17. **Conference in Harmonic Analysis in Honor of E.M. Stein**, Princeton University, Princeton, NJ. (Mar. 1990, p. 334)

19–25. **Differentialgeometrie im Grossen**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

22–24. **Second International Conference on Algebraic Methodology and Software Technology, (AMAST)**, Iowa City, IA. (Apr. 1990, p. 501)

26–June 1. **Optimalsteuerung und Variationsrechnung-Optimal Control**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

* 29–June 1. **Eighth Biennial Conference of the Association of Christians in the Mathematical Sciences**, Wheaton College, Wheaton, IL.

INVITED SPEAKER: J. Richards, Brown Univ.
CALL FOR PAPERS: Abstract deadline for other papers: Nov. 15, 1990.

INFORMATION: R.L. Brabenec, Wheaton College, Wheaton, IL 60187; 708-260-3869.

June 1991

June 1991. **Third IMACS International Symposium on Computational Acoustics**, Harvard Univ., Cambridge, MA. (Mar. 1990, p. 334)

2–8. **Diskrete Geometrie**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

3–7. **1991 Annual Meeting of the Statistical Society of Canada**, Toronto, Ontario, Canada. (Mar. 1990, p. 334)

9–15. **Singuläre Störungsrechnung**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

10–14. **Bernoulli Society Twentieth Conference on Stochastic Processes and their Applications**, Nahariya, Israel. (Nov. 1989, p. 1254)

*13–15. **Western Sectional Meeting**, Portland State University, Portland, Oregon.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

17–21. **1991 International Symposium on the Mathematical Theory of Networks and Systems (MTNS-91)**, International Conference Center Kobe, Kobe, Japan. (Nov. 1989, p. 1254)

17–21. **European Conference on Elliptic and Parabolic Problems**, Pont á Mousson, France. (May/Jun. 1990, p. 613)

*23–29. **Mathematische Methoden des VLSI-Entwurfs und des Distributed Computing**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: M.J. Fischer, New Haven; M. Fontet, Paris; G. Hotz, Saarbrücken.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*26–28. **Third IMACS International Symposium on Computational Acoustics**, Harvard University, Cambridge, MA.

CHAIRMEN: D. Lee (Naval Underwater Systems Center), A. Robinson (Harvard Univ.), R. Vichnevetsky (Rutgers Univ.).
CONFERENCE TOPICS: State-of-the-art developments in computational aspects of 3-dimensional problems in long-range propagations, scattering, fluid-elastic and bottom interactions, ocean-acoustic model interface; significant developments in the application of effective methods to solve acoustic problems; accuracy and capability issues in model development; time-domain computations; solutions to acoustic problems by supercomputers.
INFORMATION: D. Lee, Code 3122, Naval Underwater Systems Center, New London, CT 06320; 203-440-4438.

30–July 6. **Elliptische Operatoren auf Singulären und Nichtkompakten Mannigfaltigkeiten**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 501)

July 1991

1–5. **The Mathematics of Nonlinear Systems**, University of Bath, United Kingdom. (Jan. 1990, p. 62)

*2–5. **European Control Conference**, Grenoble, France.

CHAIRMAN: I.D. Landau, Grenoble.
INFORMATION: Secrétariat de la Conference, GR Automatique/ENSIEG, B.P. 46, F-38402 Saint-Martin-d'Hères.

*7–13. **Computational Number Theory**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: H.W. Lenstra Jr., Berkeley; M. Pohst, Düsseldorf; H.G. Zimmer, Saarbrücken.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

8–12. **Second International Conference on Industrial and Applied Mathematics**, Washington, DC. (Apr. 1990, p. 501)

8–14. **ICOR '91 International Conference on Radicals**, Szekszárd, Hungary. (Apr. 1990, p. 502)

14–20. **Dynamische Systeme**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 502)

15–17. **Fifth IFAC/IMACS Symposium on Computer Aided Design in Control and Engineering Systems**, Swansea, UK. (Mar. 1990, p. 334)

*21–27. **Halbgruppentheorie**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: J.M. Howie, St. Andrews; W.D. Munn, Glasgow; H.J. Weinert, Clausthal-Zellerfeld.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

22–26. **Thirteenth IMACS World Congress on Computation and Applied Mathematics**, Trinity College, Dublin University, Dublin, Ireland. (Apr. 1990, p. 502)

28–August 3. **Gruppen und Geometrien**, Oberwolfach, Federal Republic of Germany. (Apr. 1990, p. 502)

August 1991

3–7. **Interamerican Conference on Mathematics Education**, Univ. of Miami, Coral Gables, FL. (Apr. 1990, p. 502)

*4–10. **Effiziente Algorithmen**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: K. Melhorn, Saarbrücken; R.E. Tarjan, Princeton.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*5–8. **ICMI-China Regional Conference on Mathematics Education**, Beijing, China.

PURPOSE: The conference provides a forum for mathematics educators to present and discuss their ideas, views, and findings and to set a direction for establishing international links and future research. The conference theme is sufficiently general in order to provide participants an opportunity to address several issues in mathematics education, with a slant towards East Asia.
SPONSOR: International Commission on Mathematical Instruction and several Chinese mathematics/mathematics education organizations.
ORGANIZER: Beijing Normal Univ., Beijing, China.
INTERNATIONAL PROGRAM COMMITTEE: Z. Shanji (China), D. Ersheng (China), H. Fujita (Japan), L.P. Yee (Singapore), J.P. Becker (U.S.A.), M. Niss (Denmark), B.F. Nebres (Philippines), M.F. Newman (Australia).
INVITED SPEAKERS: C. Deschamps

(France), L.A. Steen (U.S.A.), H. Fujita and F. Terada (Japan), Z. Shanji and D. Ersheng (China).
CALL FOR PAPERS: There will be twenty-minute sessions for contributed papers and also poster sessions. The title and abstract should be submitted as soon as possible to be considered for inclusion. Official language is English.
INFORMATION: Z. Shanji, Dept. of Math., Beijing Normal Univ., Beijing 100875, China or L. P. Yee, Dept. of Mathematics, National Univ. of Singapore, Kent Ridge, Singapore 0511, Republic of Singapore; email matleepy@nusvm.bitnet. The Second Announcement will be sent after the IPC meeting in September 1990.

*5–9. **Fourteenth International Symposium on Mathematical Programming**, Amsterdam, The Netherlands.

PROGRAM: This is the triennial scientific meeting of the Mathematical Programming Society. The meeting will offer invited and contributed lectures in parallel sessions. In addition, computer demonstrations and survey lectures highlighting developments of current interest are planned. Also, the George B. Dantzig Prize, the Fulkerson Prizes, the Orchard-Hays Prize, and the A.W. Tucker Prize will be awarded.
CONFERENCE TOPICS: Linear, integer, mixed-integer programming; interior-point and path-following algorithms; nonlinear, nonconvex, nondifferential, global optimization; Complimentary and fixed point theory; Dynamic and stochastic programming, optimal control; Game theory and multicriterion optimization; Combinatorial optimization, graphs and networks, matroids; Computational complexity; Approximative methods, heuristics; Computational geometry, VLSI-design; Implementation and evaluation of algorithms and software; Large-scale mathematical programming; Parallel computing in mathematical computing; Expert, interactive, and decision support systems; Mathematical programming on personal computers; Teaching in mathematical programming; Applications of mathematical programming in industry, government, economics, management, finance, transportation, engineering, energy, environment, agriculture, sciences and humanities.
CALL FOR PAPERS: Papers on all theoretical, computational and practical aspects of mathematical programming are welcome. The presentation of very recent results is encouraged. Deadline for submission of titles and abstracts: June 1, 1991.
INFORMATION: 14th International Symposium on Mathematical Programming, Paulus Potterstraat 40, 1071 DB Amsterdam, The Netherlands, tel: +31-20-752120; telefax: +31-20-6628136; telex: 10761 omega.nl; email: ismp@swivax.uucp or ismp@swi.psy.uva.nl.

8–11. **Joint Mathematics Meetings**, University of Maine, Orono, ME. (including the summer meetings of the AMS, AWM, MAA, and PME)

INFORMATION: H. Daly, AMS, P.O. Box 6248, Providence, RI 02940.

19–22. **1991 Joint Statistical Meetings**, Atlanta, GA. (Mar. 1988, p. 466)

*11–17. **European Young Statisticians Meeting**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: G. Alsmeyer, Kiel.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*18–24. **The Navier-Stokes Equations: Theory and Numerical Methods**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: J. Heywood, Vancouver; K. Masuda, Tokyo; R. Rautmann, Paderborn; V.A. Solonnikov, Leningrad.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*18–September 4. **Twenty-first Summer Ecole de Calcul des Probabilités**, Saint Flour, France.

CHAIRMEN: D.A. Dawson, Ottawa; B. Maisonneuve, Grenoble; J. Spencer, New York.
INFORMATION: P.L. Hennequin, Mathématiques Appliquées, F-63177 Aubière Cedex.

*21–25. **The International Conference on the Theory of Rings, Algebras, and Modules in Honor of A.I. Shirshov**, Barnaul, U.S.S.R.

CONFERENCE TOPICS: Associative algebras, rings, and modules (including representations of groups and algebras, homological algebra); Nonassociative rings and algebras (including Lie algebras, superalgebras); Ring and module methods in geometry (including algebraic geometry), analysis (including functional analysis), mathematical logic, and combinatorial algebra.
INFORMATION: Organizing Committee, International Conference on Ring Theory in Memory of A.I. Shirshov, Institute of Mathematics, Novosibirsk, 630090, U.S.S.R.

*25–31. **Klassifikation Komplex-Algebraischer Varietäten**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: K. Hulek, Bayreuth; Th. Peternell, Bayreuth; M. Schneider, Bayreuth.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

September 1991

*1–7. **Topologie**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: M. Kreck, Mainz; A. Ranicki, Edinburgh; L. Siebenmann, Paris.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*8–14. **Niedrigidimensionale Topologie**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: M. Boileau, Toulouse; K. Johannson, Knoxville; H. Zieschang, Bochum.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*8–14. **Knoten und Verschlingungen**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: U. Koschorke, Siegen; J. Levine, Waltham.

INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*15–20. **DMV-Jahrestagung 1991**, Bielefeld, Federal Republic of Germany.

ORGANIZER: J. Mennicke.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*15–21. **Geometrie der Banachräume**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: H. König, Kiel; J. Lindenstrauss, Jerusalem; A. Pelczynski, Warschau.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*22–28. **Nonlinear and Random Vibrations**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: L. Arnold, Bremen; W. Schiehlen, Stuttgart; W. Wedig, Karlsruhe.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*29–October 5. **Kombinatorik Geordneter Mengen**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: M. Aigner, Berlin; R. Wille, Darmstadt.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

October 1991

*6–12. **Arbeitsgemeinschaft mit Aktuellem Thema (wird in den Mitteilungen der DMV Heft 3/1991 bekanntgegeben)**, Oberwolfach, Federal Republic of Germany.

INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*13–19. **Geometrie**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: V. Bangert, Bern; U. Pinkall, Berlin.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*20–26. **C^*-Algebren**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: J. Cuntz, Heidelberg; U. Haagerup, Odense; L. Zsido, Stuttgart.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

November 1991

*3–9. **Mengenlehre**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: M. Magidor, Jerusalem; E.-J. Thiele, Berlin.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*9–10. **Western Sectional Meeting**, University of California, Santa Barbara.

INFORMATION: W. Drady, American Mathematical Society, P.O. Box 6248, Providence, RI 02940.

*17–23. **Singularitäten der Kontinuumsmechanik: Numerische und Konstruktive Methoden zu Ihrer Behandlung**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: W. L. Wendland, Stuttgart; J.R. Whiteman, West London.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*24–30. **Numerische Methoden der Approximationstheorie**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: D. Braess, Bochum; L.L. Schumaker, Nashville.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

December 1991

*1–7. **Statistik Stochastischer Prozesse**, Oberwolfach, F.R.G.

CHAIRMEN: H.R. Lerche, Freiburg; M.B. Woodroofe, Ann Arbor.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*8–14. **Stochastic Geometry, Geometric Statistics, Stereology**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: E. Bjorn Jensen, Aarhus; R.E. Miles, Queanbeyan W. Weil, Karlsruhe.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*15–21. **Quantenstochastik**, Oberwolfach, Federal Republic of Germany.

CHAIRMEN: L. Accardi, Rom; W. von Waldenfels, Heidelberg.
INFORMATION: Mathematisches Forschungsinstitut Oberwolfach, Geschäftsstelle: Albertstraße 24, D-7800 Freiburg im Breisgau.

*27–31. **Holiday Symposium on the Impact of Software Systems in Mathematical Research**, New Mexico State Univ., Las Cruces, NM.

PROGRAM: This year's symposium is focused on the impact of software systems in mathematical research. There will be a series of ten lectures, two each day, by J. Selfridge, of the Northern Illinois Univ. There will be additional sessions for contributed papers, research ideas, and discussion. Some support may be available for a limited number of participants.
INFORMATION: R.J. Wisner, Homotopy Theory Symposium, Dept. of Mathematical Sciences, New Mexico State Univ., Box 30001, Las Cruces, NM 88003-0001; 505-646-3901.

*1992. **IMACS Symposium on Symbolic Computation in Engineering Design**, IDN, Lille, France.

INFORMATION: P. Borne, B.P. 48, Institute Industriel du Nord, 59651 Villeneuve d'Ascq Cedex, France.

New AMS Publications

A. J. LOHWATER'S RUSSIAN-ENGLISH DICTIONARY OF THE MATHEMATICAL SCIENCES, Second Edition

Edited by Ralph P. Boas

Revised and expanded with the assistance of Alana I. Thorpe

This long-awaited update of the popular Lohwater dictionary is currently the most complete and up-to-date resource for reading and translating mathematical literature written in Russian. Hundreds of new words have been added, and existing entries have been amplified, corrected, and brought up-to-date to reflect current mathematical usage (though some obsolete terms were retained for users who need to consult older literature). The grammar section has been rewritten, and an appendix contains complete paradigms of a large number of selected words. In addition, at the request of many users of the dictionary, stress markings on Russian words have been added.

Intended primarily for those whose first language is English, this dictionary will prove a useful tool for researchers, editors, and translators working with Russian mathematical literature.

1980 *Mathematics Subject Classification*: 00
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POSTERS BY ANATOLY FOMENKO

"I do not really think of myself as an artist. I am a mathematician. To me, my drawings are photographs of some strange and interesting mathematical world." —Anatoly Fomenko, in an interview with *Insight* magazine.

Anatoly Fomenko is a Soviet topologist with a special gift for expressing abstract mathematical concepts through art. Some of his work resembles that of M. C. Escher in its meticulous rendering of shapes and patterns, while other pieces seem to be more visceral expressions of mathematical ideas. Stimulating to the imagination and to the eye, his rich and evocative work can be interpreted and appreciated in various ways—mathematical, aesthetic, or emotional.

In anticipation of the 1991 publication of a full volume of Fomenko's artwork, the AMS is now offering posters of four of his most striking pieces. Handsomely designed and suitable for framing, these posters would be a provocative conversation piece for home or office. They would also make excellent gifts. Photos of posters on page 756.

The cylinder of a continuous mapping. Given two topological spaces and a continuous mapping between them, one can "join" a point x to its image under the map, to obtain what is known as the cylinder of the mapping. This painting, rich in reds and maroon, is a poetic rendering of various mapping cylinders. A group of seagulls flies around a truncated cone, which represents a map that "enlarges" the domain space. In color.

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Homotopy groups of spheres. One important unsolved problem is the computation of the homotopy groups of spheres, which are formed by the classes of homotopic mappings from one sphere onto another. This picture shows how a large sphere crumples, folds, and layers itself as it maps homotopically onto a smaller sphere. It can also be seen as a haunting image of a castle on the edge of a cliff, against a swirling yellow sky. In color.

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RING THEORY 1989 IN HONOR OF S. A. AMITSUR

Louis Rowen, Editor

(Israel Mathematical Conference Proceedings, Volume 1)

This is the first volume in a new series, *Israel Mathematical Conference Proceedings*, published by the Weizmann Science Press of Israel. The volume contains the proceedings of The Ring Theory Symposium at Bar-Ilan University and The Division Algebra Workshop at Hebrew University, which were held in honor of S. A. Amitsur in late 1988 and early 1989. Virtually every major algebraist in Israel contributed to these events by inviting participants for a period coinciding with the conferences.

The papers in this volume range from presentations of current research to survey talks and expositions and represent contributions by some of the world's leading experts in algebra and ring theory.

Contents

Polynomial identity ring; *Group algebras, crossed products and enveloping algebras*; *General ring theory*; *Division rings and central simple algebra*.

1980 *Mathematics Subject Classifications*: 16, 17
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THE LEGACY OF JOHN VON NEUMANN

James G. Glimm, John Impagliazzo, and Isadore Singer, Editors

(Proceedings of Symposia in Pure Mathematics, Volume 50)

The ideas of John von Neumann have had a profound influence on modern mathematics and science. One of the great thinkers of our century, von Neumann initiated major branches of mathematics—from operator algebras to game theory to scientific computing—and had a fundamental impact on such areas as self-adjoint operators, ergodic theory and the foundations of quantum mechanics, and numerical analysis and the design of the modern computer.

This volume contains the proceedings of an AMS Symposium in Pure Mathematics, held at Hofstra University, in May 1988. The symposium brought together some of the foremost researchers in the wide range of areas in which von Neumann worked. These articles illustrate the sweep of von Neumann's ideas and thinking and document their influence on contemporary mathematics. In addition, some of those who knew von Neumann when he was alive have presented here personal reminiscences about him. This book is directed to those interested in operator theory, game theory, ergodic theory, and scientific computing, as well as to historians of mathematics and others having an interest in the contemporary history of the mathematical sciences. This book will give readers an appreciation for the workings of the mind of one of the mathematical giants of our time.

Contents

Marina v. N. Whitman, *John von Neumann: A personal view*; **Peter D. Lax**, *Remembering John von Neumann*; **Françoise Ulam**, *Nonmathematical reminiscences about Johnny von Neumann*; **Israel Halperin**, *The extraordinary inspiration of John von Neumann*; **Nicholas A. Vonneuman**, *The philosophical legacy of John von Neumann, in light of its inception and evolution in his formative years*; **George W. Mackey**, *Von Neumann and the early days of ergodic theory*; **Donald S. Ornstein**, *Von Neumann and ergodic theory*; **Hillel Furstenberg**, *Nonconventional ergodic averages*; **Francis J. Murray**, *The rings of operators papers*; **Richard V. Kadison**, *Operator algebras – An overview*; **Alain Connes**, *Introduction à la géométrie non-commutative*; **Huzihiro Araki**, *Some of the legacy of John von Neumann in physics: Theory of measurement, quantum logic, and von Neumann algebras in physics*; **Arthur M. Jaffe**, *Mathematics motivated by physics*; **Irving E. Segal**, *The mathematical implications of fundamental physical principles*; **Herman H. Goldstine and John von Neumann**, *On the principles of large scale computing machines*; **James Glimm**, *Scientific computing: Von Neumann's vision, today's realities, and the promise of the future*; **Z-S. She, Eric Jackson, and S. A. Orszag**, *Intermittency of turbulence*; **E. Clementi, S. Chin, G. Corongiu, J. Given, G. C. Lie, M. Migliore, and P. Procacci**, *Supercomputer simulations of the interaction of biomolecules in solution*; **Jack D. Cowan**, *Von Neumann and neural networks*; **Elwyn R. Berlekamp**, *Two-person, perfect-information games*; **William Aspray**, *The origins of John von Neumann's theory of automata*; **Nicholas Pippenger**, *Developments in the synthesis of reliable organisms from unreliable components*.

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OPERATOR THEORY/OPERATOR ALGEBRAS AND APPLICATIONS

William B. Arveson and Ronald G. Douglas, Editors

(Proceedings of Symposia in Pure Mathematics, Volume 51)

Operator theory has come of age during the last twenty years. The subject has developed in several directions using new and powerful methods that have led to the solution of basic problems previously thought to be inaccessible. In addition, operator theory has had fundamental connections with a range of other mathematical topics. For example, operator theory has made mutually enriching contacts with other areas of mathematics, such as algebraic topology and index theory, complex analysis, and probability theory.

The algebraic methods employed in operator theory are diverse and touch upon a broad area of mathematics. There have been direct applications of operator theory to systems theory and statistical mechanics. And significant problems and motivations have arisen from the subject's traditional underpinnings for partial differential equations.

This two-volume set contains the proceedings of an AMS Summer Institute on Operator Theory/Operator Algebras, held in July 1988 at the University of New Hampshire. The Institute sought to summarize progress and examine the common points of view that now run through the subject. With contributions from some of the top experts in the field, this publication illuminates a broad range of current research topics in operator theory.

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1980 *Mathematics Subject Classifications*: 46L, 47A, 47B, 58G
ISBN 0-8218-1486-9, LC 90-33771, ISSN 0082-0717
Part 1-640 pages, Part 2-385 pages (hardcover), July 1990
Individual member $104, List price $174,
Institutional member $139
To order, please specify PSPUM/51N

AN INTRODUCTION TO CR STRUCTURES
Howard Jacobowitz

(Mathematical Surveys and Monographs, Volume 32)

The geometry and analysis of CR manifolds is the subject of this expository work, which presents all the basic results on this topic, including results from the "folklore" of the subject.

The book contains a careful exposition of seminal papers by Cartan and by Chern and Moser, and also includes chapters on the geometry of chains and circles and the existence of nonrealizable CR structures. With its detailed treatment of foundational papers, the book is especially useful in that it gathers in one volume many results that were scattered throughout the literature.

Directed at mathematicians and physicists seeking to understand CR structures, this self-contained exposition is also suitable as a text for a graduate course for students interested in several complex variables, differential geometry, or partial differential equations. A particular strength is an extensive chapter that prepares the reader for Cartan's approach to differential geometry. The book assumes only the usual first-year graduate courses as background.

Contents

CR Structures; *Some automorphism groups*; *Formal theory of the normal form*; *Geometric theory of the normal form*; *Background for Cartan's work*; *Cartan's construction*; *Geometric consequences*; *Chains*; *Chains and circles in complex projective geometry*; *Nonsolvability of the Lewy Operator*.

1980 *Mathematics Subject Classifications*: 32F25; 32-02, 53-02
ISBN 0-8218-1533-4, LC 90-608, ISSN 0076-5376
237 pages (hardcover), July 1990
Individual member $44, List price $74,
Institutional member $59
To order, please specify SURV/32N

SPECTRAL THEORY AND ANALYTIC GEOMETRY OVER NON-ARCHIMEDEAN FIELDS

Vladimir G. Berkovich

(Mathematical Surveys and Monographs, Volume 33)

The purpose of this book is to introduce a new notion of analytic space over a non-Archimedean field. Despite the total disconnectedness of the ground field, these analytic spaces have the usual topological properties of a complex analytic space, such as local compactness and local arcwise connectedness. This makes it possible to apply the usual notions of homotopy and singular homology. The book includes a homotopic characterization of the analytic spaces associated with certain classes of algebraic varieties and an interpretation of Bruhat-Tits buildings in terms of these analytic spaces. The author also studies the connection with the earlier notion of a rigid analytic space. Geometrical considerations are used to obtain some applications, and the analytic spaces are used to construct the foundations of a non-Archimedean spectral theory of bounded linear operators. This book requires a background at the level of basic graduate courses in algebra and topology, as well as some familiarity with algebraic geometry. It would be of interest to research mathematicians and graduate students working in algebraic geometry, number theory, and p-adic analysis.

Contents

The spectrum of a commutative Banach ring; *Affinoid spaces*; *Analytic spaces*; *Analytic curves*; *Analytic groups and buildings*; *The homotopy type of certain analytic spaces*; *Spectral theory*; *Perturbation theory*; *The dimension of a Banach algebra*.

1980 *Mathematics Subject Classifications*: 12J25, 32K10, 14G20, 20G25, 46P05, 46J99
ISBN 0-8218-1534-2, LC 90-830, ISSN 0076-5376
169 pages (hardcover), July 1990
Individual member $32, List price $53,
Institutional member $42
To order, please specify SURV/33N

NONLINEAR WAVE EQUATIONS, FORMATION OF SINGULARITIES

Fritz John

(University Lecture Series, Volume 2)

This is the second volume in the new University Lecture Series, designed to make more widely available some of the outstanding lectures presented in various institutions around the country. Each year at Lehigh University, a distinguished mathematical scientist presents the Pitcher Lectures in the Mathematical Sciences. This volume contains the Pitcher lectures presented by Fritz John in April 1989.

The lectures deal with existence in the large of solutions of initial value problems for nonlinear hyperbolic partial differential equations. As is typical with nonlinear problems, there are many results and few general conclusions in this extensive subject, so the author restricts himself to a small portion of the field, in which it is possible to discern some general patterns. Presenting an exposition of recent research in this area, the author examines the way in which solutions can, even with small and very smooth initial data, "blow up" after a finite time. For various types of quasi-linear equations, this time depends strongly on the number of dimensions and the "size" of the data. Of particular interest is the formation of singularities for nonlinear wave equations in three space dimensions.

Contents

Equations in one space variable; *Blow-up in higher dimensions*; *Longtime existence for solutions of nonlinear wave equations with small initial data*; *Appendix I. Uniqueness for nonlinear wave equations*; *Appendix II. Klainerman's inequality*.

1980 *Mathematics Subject Classifications*: 35L67, 35L70; 73G05
ISBN 0-8218-7001-7, LC 90-700, ISSN 1047-3998
64 pages (softcover), July 1990
Individual member $17, List price $29,
Institutional member $23
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WORLD DIRECTORY OF MATHEMATICIANS 1990

This is the ninth edition of the *World Directory of Mathematicians*, which incorporates corrections and updates to the 1986 edition. Published by the International Mathematical Union, this valuable reference book contains the names and addresses of about 40,000 mathematicians from 83 countries. Listings for the directory are based on information supplied by National Committees for Mathematics (or corresponding organizations). Listings from the 1986 edition were retained if no updated information was supplied.

Libraries and individuals alike will find this a useful directory to have on hand.

1980 *Mathematics Subject Classification*: 00
1239 pages (softcover), July 1990
Price $40
To order, please specify WRLDIR/9N

The following videotapes are now available through the AMS.

$ax^2 + hxy + cy^2 = n$
John H. Conway

Focusing on a pictorial approach to the theory of integral quadratic forms, John H. Conway combines an impressive command of the theory with deep intuitive insight to produce an illuminating and engaging videotaped lecture. The quadratic forms of the type in the title of this lecture lead to a beautiful picture in the hyperbolic plane—a picture that not only allows for understanding of the deeper properties of these forms but also leads to an algorithm for their solution. Taking viewers on a trip down "the river," with a forest of positive integers on one side, and negative integers on the other, Conway shows how this simple representation elucidates certain properties of the forms. His approach also leads to a discussion of an alternative, pictorial representation of the real numbers that reveals their Diophantine structure, leading naturally to the concept of the continued fraction representation. This lecture is fascinating not only in its subject matter but also in revealing the way this master mathematician wends his intuitive way through the topic as he leaves the technicalities behind. The videotape would be appropriate for advanced undergraduates with background in number theory.

1980 *Mathematics Subject Classification*: 11
ISBN 0-8218-8027-6
NTSC format on 1/2" VHS videotape; approx. one hour, 1990
Price $59
To order, please specify VIDCONWAY/N

CRYSTALS, IN EQUILIBRIUM AND OTHERWISE
Jean E. Taylor

The opening shots on this videotape, showing computer-generated pictures of soap bubbles and crystals, beautifully illustrate the fascination of this topic. Soap films are the physical system that gave rise to the mathematical subject of minimal surfaces; their surface energy is proportional to the surface area. Like fluid interfaces, interfaces involving crystals also have surface energies, but the surface energy per unit surface area depends on the normal directions of the interfaces. Those portions of crystal surfaces or interfaces which minimize surface energy have given rise to the study of crystalline minimal surfaces. With their facetted structure, these surfaces share the beauty of both crystals and soap films. Taylor communicates her great enthusiasm for the subject as she presents a variety of results and pictures. Audiences having a background at the level of an advanced undergraduate in mathematics will enjoy this presentation, and it is likely to be of interest to physicists and engineers.

1980 *Mathematics Subject Classifications*: 49, 51
ISBN 0-8218-8029-2
NTSC format on 1/2" VHS videotape; approx. one hour, 1990
Price $59
To order, please specify VIDTAYLOR/N

THE TRANSITION TO CHAOS: THE ORBIT DIAGRAM AND THE MANDELBROT SET
Robert L. Devaney
A Science Television Production

In this videotaped lecture, Devaney explores and explains two of the most fascinating images in the study of dynamical systems: the orbit (or bifurcation) diagram, and the Mandelbrot set. Because both of these images result from iterations of quadratic functions, the level of mathematical sophistication required to understand the lecture is minimal. The main goal of the lecture is to describe the relationship between these two images, how they are generated, and what they mean mathematically. Devaney also describes several important related concepts in dynamical systems theory, including period doubling bifurcations, Feigenbaum's number, Sarkovskii's theorem, and the role of critical orbits.

1980 *Mathematics Subject Classification*: 58
NTSC format on 1/2" VHS videotape; approx. one hour, 1990
Price $59
To order, please specify VIDDEV/2N

Combination book and videotape offers:
The transition to chaos: The orbit diagram and the Mandelbrot set with Robert L. Devaney (VIDDEV/2N) may be purchased with the following:

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The videotape, book and *Chaos, fractals and dynamics: Computer experiments in mathematics*, with Robert L. Devaney (VIDDEVANEY/N).
Individual member $120, List price $144, Institutional member $131
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New Video Series

Progress in Mathematics

This lecture series, begun in the summer of 1989, is designed to highlight some of the important trends and active areas in the mathematical sciences today. The speakers have been chosen for their skill in presenting expository lectures and for their command of the history and development of the area of their talk. Written lecture notes accompany most of the videotapes, leaving the speaker free to set aside technical details and discuss major themes. In addition, the 90-minute format allows for more in-depth coverage of the area. The

lectures would be suitable for researchers, graduate students, or advanced undergraduates.

MATHEMATICAL PROBLEMS OF LIQUID CRYSTALS
Haim Brezis

Liquid crystals are now an everyday phenomenon, with the advent of liquid crystal displays in clocks, watches, calculators, computers, and other devices. Such materials are unusual because they have an orientational order, but do not have the strict configurational order of solids. This videotaped lecture provides an in-depth view of some of the mathematical aspects of liquid crystals. Brezis discusses some current results on the deformation energy of liquid crystals. These results not only provide an excellent example of how physical phenomenon can provide new mathematical problems, but also shows the way in which mathematical analysis can point physicists in the direction of new understanding. In addition, the fascination of this topic goes well beyond the connection to liquid crystals, forging an unusual combination of techniques from various fields such as nonlinear partial differential equations, functional analysis, differential geometry, geometric measure theory, topology, numerical analysis, and graph theory. Lecturing with clarity, insight, and thoroughness, Brezis leads the audience on a journey into this absorbing topic at the frontier of research. In addition to researchers interested in this area, graduate students or advanced undergraduates should find this lecture accessible.

1980 *Mathematics Subject Classifications*: 35J, 58C, 58E
ISBN 0-8218-8030-6
NTSC format on 1/2" VHS videotape; approx. 90 minutes, 1990
Price $59
To order, please specify VIDBREZIS/N

APPLICATIONS OF PDE METHODS BY GROMOV, FLOER, AND OTHERS TO SYMPLECTIC GEOMETRY
Dusa McDuff

The past few years have seen several exciting developments in the field of symplectic geometry, and researchers in this area have begun to make progress in solving many important and hitherto inaccessible problems. The new techniques making this possible have come both from the calculus of variations and from the theory of elliptic partial differential operators. With impressive breadth of knowledge and clarity of exposition, McDuff examines some of these new developments, including Gromov's results using elliptic methods, and how Floer applied these elliptic techniques to develop a new approach to Morse theory. This latter result has important applications in the theory of 3- and 4-manifolds, as well as in symplectic geometry. In addition to researchers interested in this area, graduate students or advanced undergraduates should find this lecture accessible.

1980 *Mathematics Subject Classifications*: 53C15, 58G05
ISBN 0-8218-8031-4
NTSC format on 1/2" VHS videotape; approx. 90 minutes, 1990
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HARMONIC ANALYSIS AND PARTIAL DIFFERENTIAL EQUATIONS
Mario Milman and Tomas Schonbek, Editors
(Contemporary Mathematics, Volume 107)

This volume contains the proceedings of an AMS Special Session on the Mathematics of Nonlinear Science, held in Phoenix in January 1989. This area of research encompasses a large and rapidly growing set of ideas concerning the relationship of mathematics to science, in which the fundamental laws of nature are extended beyond common sense into new areas where the dual aspects of order and chaos abound.

These papers, generally analytic in nature, deal primarily with mathematical aspects of physical science and non-chaotic phenomenon. Important new areas are discussed, such as instability, global extensions of KAM theory, new ideas concerning integrable systems, bifurcation and its applications in fluids, and various aspects of gauge theory. Altogether, the topics explored here represent an excellent survey of some of the new research in the mathematics of nonlinear science.

Contents

B. Barcelo, L. Escauriaza, and E. Fabes, *Gradient estimates at the boundary for solutions to nondivergence elliptic equations*; **L. A. Caffarelli**, *Interior regularity of solutions to Monge Ampère equations*; **M. Cotlar and C. Sadosky**, *The Helson-Szegö theorem in L^p of the bidimensional torus*; **B. E. J. Dahlberg and G. Verchota**, *Galerkin methods for the boundary integral equations of elliptic equations in nonsmooth domains*; **R. Fefferman**, *Some applications of Hardy spaces and BMO in harmonic analysis and partial differential equations*; **B. Jawerth, C. Perez, and G. Welland**, *The positive cone in Triebel-Lizorkin spaces and the relation among potential and maximal operators*; **R. Johnson**, *Changes of variable and A_p weights*; **C. E. Kenig**, *Progress on two problems posed by Rivière*; **A. C. Lazer and P. J. McKenna**, *Fredholm theory for periodic solutions of some semilinear P.D.E.s with homogeneous nonlinearities*; **W. A. Strauss**, *Stability of solitary waves*.

1980 *Mathematics Subject Classifications*: 35-06, 42-06
ISBN 0-8218-5113-6, LC 90-34635, ISSN 0271-4132
129 pages (softcover), July 1990
Individual member $23, List price $38,
Institutional member $30
To order, please specify CONM/107N

MATHEMATICS OF NONLINEAR SCIENCE
Melvyn S. Berger, Editor
(Contemporary Mathematics, Volume 108)

This book brings together ten papers presented at the Conference on Harmonic Analysis and Partial Differential Equations, held in April 1987 at Florida Atlantic University. The papers illuminate the relationship between harmonic analysis and partial differential equations and present results

of some of the foremost experts in these areas. Among the topics covered are: application of fully nonlinear, uniformly elliptic equations to the Monge Ampère equation; estimates for Green functions for the purpose of studying Dirichlet problems for operators in non-divergence form; an extension of classical potential theory to the case of nonsmooth domains; the relation between Riesz potentials and maximal fractional operators due to Muckenhoupt and Wheeden; and the Lax-Phillips scattering theory applied to the double Hilbert transform. Directed at research mathematicians and graduate students, the papers require knowledge of the classical tools of analysis, such as measure theory, Sobolev spaces, and potential theory.

Contents

Roger K. Alexander, *Multiple steady states in tubular chemical reactors*; **M. S. Berger**, *Two new approaches to large amplitude quasi-periodic motions of certain nonlinear Hamiltonian systems*; **Y. Y. Chen**, *Vortices for the Ginzburg-Landau equations–the nonsymmetric case in bounded domain*; **Andrew Szeri and Philip Holmes**, *Nonlinear stability and bifurcation in Hamiltonian systems with symmetry*; **Eli Isaacson and Blake Temple**, *Nonlinear resonance in inhomogeneous systems of conservation laws*; **George H. Knightly and D. Sather**, *Bifurcation and stability in rotating, plane Couette-Poiseuille flow*; **Kenneth R. Meyer and Dieter S. Schmidt**, *Bifurcations of central configurations in the N-body problem*; **M. S. Berger and J. Nee**, *Leapfrogging of vortex filaments in an ideal fluid*; **J. W. Neuberger**, *Calculation of sharp shocks using Sobolev gradients*; **John Palmer and Craig A. Tracy**, *Monodromy preserving deformation of the Dirac operator acting on the hyperbolic plane*; **M. S. Berger and M. Schechter**, *Bifurcation from equilibria for certain infinite-dimensional dynamical systems*; **Victor Shubov**, *On dynamics of discrete and continuous σ-models (chiral fields) with values in Riemannian manifolds*; **Srdjan Stojanovic**, *Direct study for some nonlinear elliptic control problems*.

1980 *Mathematics Subject Classifications*: 70-XX, 70DXX, 70FXX, 70HXX, 70KXX; 34BXX, 35-XX, 35BXX, 49-XX, 49FXX, 58-XX, 58BXX
ISBN 0-8218-5114-4, LC 90-574, ISSN 0271-4132
154 pages (softcover), July 1990
Individual member $19, List price $32,
Institutional member $26
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A MULTIPLE DISJUNCTION LEMMA FOR SMOOTH CONCORDANCE EMBEDDINGS

Thomas G. Goodwillie

(Memoirs of the AMS, Number 431)

Requiring background in basic differential topology, this book is aimed at researchers interested in the homotopy type of spaces of smooth embeddings and spaces of diffeomorphisms. The author provides a proof of a useful connectivity estimate in the theory of concordances (or pseudo-isotopies), generalizing Morlet's result from triads to n-ads. The method of proof is a differentiable general position technique analogous to piecewise-linear "sunny collapsing."

Contents

Introduction: *Spaces of concordances*; *Known results*; *The multiple disjunction lemma*; *Sketch of the proof*; **Preliminaries**: *Definitions, etc.*; *$(a+1)$-ads and connectivity*; *Sunny collapsing*; *Multijets and general position*; *Approximation by polynomials*; **The collection Z of multijet sets**: *Invariant algebraic sets of complex multijets*; *Operations on sets of multijets*; *Z*; *Singular sets for fibered concordances*; **Proof of Theorem D**: *One last sunny collapse*.

1980 *Mathematics Subject Classification*: 57
ISBN 0-8218-2493-7, LC 90-31826, ISSN 0065-9266
317 pages (softcover), July 1990
Individual member $22, List price $36,
Institutional member $29
To order, please specify MEMO/431N

THE MAXIMAL FACTORIZATIONS OF THE FINITE SIMPLE GROUPS AND THEIR AUTOMORPHISM GROUPS

Martin W. Liebeck, Cheryl E. Praeger, and Jan Saxl

(Memoirs of the AMS, Number 432)

Factorizations of finite groups as a product of two proper subgroups arise naturally in several areas of group theory, geometry, and applications. In this book, the authors determine all factorizations of the finite simple groups and their automorphism groups as a product of two maximal subgroups. The proof involves detailed study of the geometry of simple groups, and there is a substantial introductory section presenting this material. One of the major unsolved problems in the theory of finite groups is the classification of the maximal subgroups of the finite simple groups and their automorphism groups. As an application of their main results, the authors present an effective classification of the maximal subgroups of one such class, the finite alternating and symmetric groups. Requiring a basic knowledge of group theory, the book is directed at research mathematicians and graduate students.

Contents

Classical groups of large dimension: factorizations as a product of two geometric subgroups; *Classical groups of large dimension: factorizations in which one of the factors is non-geometric*; *Classical groups of small dimension*; *Factorizations of sporadic groups*; *Factorizations of alternating groups*; *Factorizations of exceptional groups of Lie type*; *On maximal subgroups of symmetric and alternating groups*; *Lower bounds for dimensions of representations of sporadic groups*; *Uniqueness of certain representations of Suz and Co_1*; *Orbit decomposition of $B_4(q)$ on a spin module*.

1980 *Mathematics Subject Classifications*: 20D40, 20B35, 20D06, 20D08, 20E40
ISBN 0-8218-2494-5, LC 90-31827, ISSN 0065-9266
151 pages (softcover), July 1990
Individual member $22, List price $36,
Institutional member $29
To order, please specify MEMO/432N

GEOMETRIC FUNCTION THEORY IN SEVERAL COMPLEX VARIABLES

Junjiro Noguchi and Takushiro Ochiai

(Translations of Mathematical Monographs, Volume 80)

This is an expanded English-language version of a book by the same authors that originally appeared in the Japanese. The book serves two purposes. The first is to provide a

self-contained and coherent account of recent developments in geometric function theory in several complex variables, aimed at those who have already mastered the basics of complex function theory and the elementary theory of differential and complex manifolds. The second goal is to present, in a self-contained way, fundamental descriptions of the theory of positive currents, plurisubharmonic functions, and meromorphic mappings, which are today indispensable in the analytic and geometric theories of complex functions of several variables. The book should prove useful for researchers and graduate students alike.

Contents

Hyperbolic manifolds; *Measure hyperbolic manifolds*; *Positive currents and plurisubharmonic functions*; *Meromorphic mappings*; *Nevanlinna theory*; *Value distribution of holomorphic curves*.

1980 *Mathematics Subject Classifications*: 32H30; 32F05
ISBN 0-8218-4533-0, LC 90-546, ISSN 0065-9282
296 pages (hardcover), July 1990
Individual member $47, List price $78,
Institutional member $62
To order, please specify MMONO/80N

MATHEMATICAL PROBLEMS OF TOMOGRAPHY

I. M. Gelfand and S. G. Gindikin, Editors

(Translations of Mathematical Monographs, Volume 81)

As early as 1917, Radon derived an explicit formula for the reconstruction of a function on the plane, given its integrals over all lines. In the late 1960s, the first applications of the Radon formula appeared, in radio astronomy and then in electron micrography. The use of the Radon formula for constructing tomograms, made possible by the advent of the computer, saw its first use in clinical medicine in 1970 and earned its developers the Nobel Prize in medicine.

Today, practical application of the Radon transform, especially in medical tomography, has continued to capture the attention of mathematicians, partly because of the range of new applications that have been found. But the most fascinating aspect for mathematicians may be the opportunity to apply deep mathematics to tackle new problems arising from real-world applications.

The papers in this volume cover various problems arising from and related to computerized tomography. The main idea unifying the papers is that the methods used satisfy strong requirements imposed by practical applications of computerized tomography, such as reconstruction of nonsmooth functions, pointwise convergence, and discretization in computational algorithms. The papers draw upon a broad range of mathematical areas, including integral geometry, the theory of several complex variables, the theory of distributions, and integral transformations. In addition, applications to reconstruction of biological objects and mathematical economics are given.

Contents

I. M. Gelfand and S. G. Gindikin, *Introduction. Integral geometry and tomography*; **D. A. Popov**, *On convergence of a class of algorithms for the inversion of the numerical Radon transform*; **A. B. Goncharov**, *Three-dimensional reconstruction of arbitrarily arranged identical particles given their projections*; **M. S. Gelfand and A. B. Goncharov**, *Spatial rotational alignment of identical particles given their projections: theory and practice*; **V. P. Palamodov**, *Some singular problems in tomography*; **N. D. Vvedenskaya and S. G. Gindikin**, *Discrete Radon transform and image reconstruction*; **G. M. Henklin and A. A. Shananin**, *Bernstein theorems and the Radon transform. Application to the theory of production functions*; **V. M. Buchstaber amd V. K. Maslov**, *Mathematical models and algorithms of tomographic synthesis of wave fields and inhomogeneous media*.

1980 *Mathematics Subject Classifications*: 44A05, 44A15; 46F12, 44-04, 90A15, 32A25
ISBN 0-8218-4534-9, LC 90-845, ISSN 0065-9282
267 pages (hardcover), July 1990
Individual member $58, List price $96,
Institutional member $77
To order, please specify MMONO/81N

LINEAR DIFFERENTIAL EQUATIONS IN THE COMPLEX DOMAIN: PROBLEMS OF ANALYTIC CONTINUATION

Yasutaka Sibuya

(Translations of Mathematical Monographs, Volume 82)

Research in differential equations is usually oriented toward explicit results and motivated by applications. Many clever methods have been discovered in this way, but, when problems of more fundamental difficulty arise, researchers must find something intrinsic in the mathematics itself in order to make progress. As research in topology, algebraic geometry, and functions of several complex variables have advanced, many methods useful in such fields were introduced into the study of differential equations.

The main part of this book is a translation of a 1976 book originally written in Japanese. The book, focusing attention on intrinsic aspects of the subject, explores some problems of linear ordinary differential equations in complex domains. Examples of the problems discussed include the Riemann problem on the Riemann sphere, a characterization of regular singularities, and a classification of meromorphic differential equations. Since the original book was published, many new ideas have developed, such as applications of D-modules, Gevrey asymptotics, cohomological methods, k-summability, and studies of differential equations containing parameters. Five appendices, added in the present edition, briefly cover these new ideas. In addition, more than 100 references have been added.

This book will introduce readers to the essential facts concerning the structure of solutions of linear differential equations in the complex domain, as well as illuminate the intrinsic meaning of older results by means of more modern ideas. A useful reference for research mathematicians on various fundamental results, this book would also be suitable as a textbook in a graduate course or seminar.

Contents

Structures of analytic continuation; *Existence theorem of Grauert*; *A theorem of G. D. Birkhoff*; *The Riemann problem*; *Linear differential equations on a sectorial domain*; *The Stokes phenomena*; *Appendix* 1. *The Hukuhara Turrittin Theorem in terms of* $D_{\mathcal{K}}$*-modules*; *Appendix* 2. *Gevrey asymptotics*; *Appendix* 3. *Cohomological methods*; *Appendix* 4.

k-Summability; *Appendix* 5. *Differential equations containing parameters*.

1980 *Mathematics Subject Classifications*: 34A20, 32D20, 32E10, 34E05, 30E15
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REPRÉSENTATIONS LINÉAIRES DES GROUPES FINIS

(Astérisque, Number 181–182)

This volume brings together fifteen research papers presented at the International Conference on Linear Representations of Finite Groups, held in Luminy in May 1988. One of the major themes of the volume is the notion of block. Among the topics discussed are studies of Alperin's conjecture, the isomorphism problem for group algebras, and blocks of classical groups. Local methods, source algebras, Auslander-Reiten theory, Morita equivalence, isometries, permutation modules, derived categories, cohomological methods, and Mackey functors are some of the key concepts touched on here. Apart from the focus on the theme of blocks, readers will also find other topics represented here, such as representations of finite groups of Lie type, linear codes, and character theory.

Content

Christine Bessenrodt, *Some new block invariants coming from cohomology*; **Robert Boltje**, *A canonical Brauer induction formula*; **Michel Broué**, *Isométries parfaites, types de blocs, catégories dérivées*; **Marc Cabanes**, *A criterion for complete reducibility and some applications*; **Françis Digne and Jean Michel**, *On Lusztig's parametrization of characters of finite groups of Lie type*; **Michel Enguehard**, *Isométries parfaites entre blocs de groupes symétriques*; **Karin Erdmann**, *On the local structure of tame blocks*; **Odile Garotta**, *On Auslander-Reiten systems*; **Reinhard Knörr and Wolfgang Willems**, *The automorphism groups of generalized Reed-Muller codes*; **Burkhard Külshammer**, *Morita equivalent blocks in Clifford theory of finite groups*; **Udo Leisering**, *On the p-part of character degrees of solvable groups*; **Lluis Puig**, *Algèbres de source de certains blocs des groupes de Chevalley*; **Geoffrey R. Robinson and Reiner Staszewski**, *More on Alperin's conjecture*; **Leonard L. Scott**, *Defect groups and the isomorphism problem*; **Jacques Thévenaz and Peter Webb**, *Mackey functor versions of a conjecture of Alperin*.

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Recent Developments in Geometry

S.-Y. Cheng, H.Choi, and Robert E. Greene, Editors
(Contemporary Mathematics, Volume 101)

This volume is the outgrowth of a Special Session on Geometry, held at the November 1987 meeting of the AMS at the University of California at Los Angeles. The unusually well-attended session attracted more than sixty participants and featured over forty addresses by some of the day's outstanding geometers. By common consent, it was decided that the papers to be collected in the present volume should be surveys of relatively broad areas of geometry, rather than detailed presentations of new research results. A comprehensive survey of the field is beyond the scope of a volume such as this. Nonetheless, the editors have sought to provide all geometers, whatever their specialties, with some insight into recent developments in a variety of topics in this active area of research.

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THEORY OF FUNCTIONS AND RELATED QUESTIONS OF ANALYSIS

L. D. Kudryavtsev, Editor

(Proceedings of the Steklov Institute, Volume 180)

This volume contains the proceedings of the All-Union Conference on the Theory of Functions and Related Questions of Analysis, held in Dnepropetrovsk, U.S.S.R., in the summer of 1985. The conference was held in honor of the 80th birthday of Sergeĭ Mikhaĭlovich Nikol′skiĭ.

The collection contains a survey of the work of Nikol′skiĭ as well as papers on the theory of approximation of functions, the metric theory of functions, the theory of spaces of differentiable functions of several variables, and applications of these ideas.

1980 *Mathematics Subject Classifications*: 01, 11, 26, 28, 30, 31, 34, 35, 39, 40, 41, 42, 44, 45, 46, 47,53, 54, 65 and others
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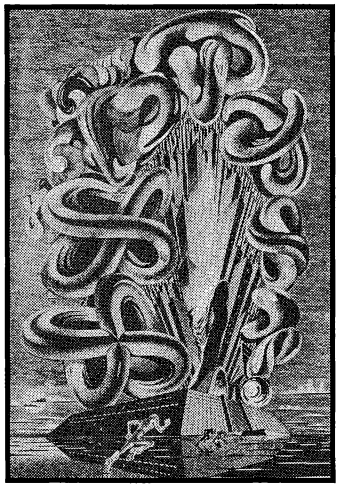
POSTERS BY ANATOLY FOMENKO

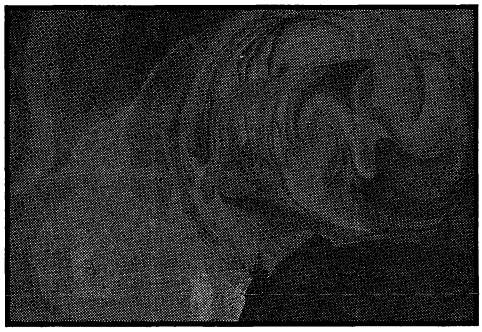
"I do not really think of myself as an artist. I am a mathematician. To me, my drawings are photographs of some strange and interesting mathematical world." ---Anatoly Fomenko, in an interview with Insight magazine.

Anatoly Fomenko is a Soviet topologist with a special gift for expressing abstract mathematical concepts through art. Some of his work resembles that of M.C. Escher in its meticulous rendering of shapes and patterns, while other pieces seem to be more visceral expressions of mathematical ideas. Stimulating to the imagination and to the eye, his rich and evocative work can be interpreted and appreciated in various ways---mathematical, aesthetic, or emotional.

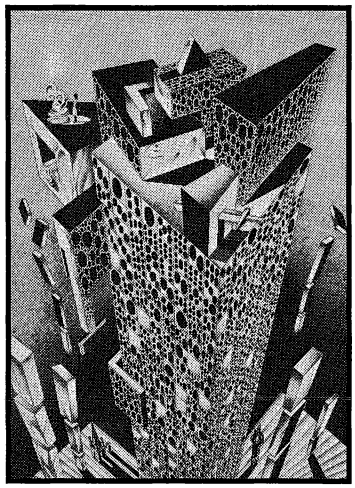
In anticipation of the 1991 publication of a full volume of Fomenko's artwork, the AMS is now offering posters of four of his most striking pieces.



The cylinder of a continuous mapping. (Photo not given) Given two topological spaces and a continuous mapping between them, one can "join" a point x to its image under the map, to obtain what is known as the cylinder of the mapping. This painting, rich in reds and maroon, is a poetic rendering of various mapping cylinders. A group of seagulls flies around a truncated cone, which represents a map that "enlarges" the domain space. In color . ***Price*** **$15. Code FOMPOS/1NA**



A two-dimensional sphere in three-dimensional space can be turned inside out. It is a remarkable topological fact that a two-dimensional sphere can be "turned inside out" by a smooth homotopy in the class of immersions. Fomenko depicts this amazing transformation in eight steps in this surrealistic illustration. In black and white. ***Price*** **$12. Code FOMPOS/2NA**



Homotopy groups of spheres. One important unsolved problem is the computation of the homotopy groups of spheres, which are formed by the classes of homotopic mappings from one sphere to another. This picture shows how a large sphere crumples, folds, and layers itself as it maps homotopically onto a smaller sphere. It can also be seen as a haunting image of a castle on the edge of a cliff, against a swirling yellow sky. In color. ***Price*** **$15. Code FOMPOS/4NA**

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The remarkable numbers π and *e*, I. This pen-and-ink illustration represents the decimal expansions of π and e by a tower of white blocks. Each block carries a number of black discs, corresponding to the digit in the expansion. Meticulously textured and captivatingly detailed, this enigmatic picture projects a sense of wonder and mystery. ***Price*** **$12. Code FOMPOS/3NA**

Handsomely designed and suitable for framing, these posters would be a provocative conversation piece for home or office. They would also make excellent gifts.

Miscellaneous

Personals

Neal R. Amundson, Cullen Professor of Chemical Engineering and professor of mathematics, University of Houston, has been named the recipient of the National Academy of Engineering's Founders Award in recognition of his "contributions to the advancement of the discipline of chemical engineering, blending mathematical analysis and practical applications, and for inspiring generations of students to attain leadership positions in academia and industry."

Thomas Branson, of the University of Iowa, has been promoted to full professor at that institution.

Do Ngoc Diep, of the Institute of Mathematics, Hanoi, has been appointed professor and senior researcher of the chair for "Geometry, Topology and their applications in physics and mechanics" at that institution.

Neal D. Hulkower, of The Mitre Corporation, has been honored by having an asteroid named after him. Designated (4285) Hulkower, the asteroid is one of the myriad of small planets orbiting the sun between Mars and Jupiter and ranging in size from a fraction of a mile to about 620 miles in diameter. The asteroid was discovered on July 11, 1988 at Mt. Palomar Observatory by Eleanor F. Helin, a research colleague in California. The citation from the International Astronomical Union states that the asteroid has been "named in honor of Neal D. Hulkower, mathematician, scientist, and good friend of the discoverer with a special interest in celestial mechanics".

Vaughan F.R. Jones, of the University of California, Berkeley, was elected to Fellowship of the Royal Society on March 15, 1990.

Lee Lorch, Professor Emeritus of York University, was awarded an honorary degree by the City University of New York on May 25 at the commencement exercises of the City College of New York. The degree was conferred in recognition of his "...distinguished contributions in the field of mathematics and for his lifelong dedication to human rights, justice, and equality...".

Ved P. Madan, of Red Deer College, has been appointed professor of mathematics at Indiana University.

Gene W. Medlin is retiring from Stetson University and has been named Professor Emeritus of that institution.

Bertram Mond, of La Trobe University, has been appointed Dean of the School of Mathematical and Information Sciences at that institution.

Deborah A. Nolan, of the University of California, Berkeley, has been honored with the Prytanean Faculty Award recognizing an outstanding young woman faculty member at that institution.

Marjorie Lee Senechal, of Smith College, has been named the Louise Wolff Kahn Professor of Mathematics at that institution.

Monty J. Strauss, of Texas Tech University, has been appointed Associate Dean for Admissions and Information Systems in the Graduate School at that institution.

René Thom, of the Institute des Hautes Etudes Sciences, was elected an honorary member of the London Mathematical Society.

Deaths

Robert A. Bonic, of Boston, Massachusetts, died on May 29, 1990, at the age of 57. He was a member of the Society for 30 years.

M.S. Brodskii, of Odessa, U.S.S.R., died on December 2, 1989. He was a member of the Society for 17 years.

A.S. Galbraity, of Lakewood, New Jersey, died on January 1, 1990, at the age of 85. He was a member of the Society for 57 years.

Edward K. Haviland, of Baltimore, Maryland, died on July 17, 1989, at the age of 87. He was a member of the Society for 60 years.

Albert F. Herbst, of La Verne, California, died on April 29, 1990, at the age of 61. He was a member of the Society for 33 years.

F. Jessie MacWilliams, of Bernardsville, New York, died on May 27, 1990, at the age of 73. She was a member of the Society for 27 years.

S. Thomas Parker, of Manhattan, Kansas, died on March 14, 1990, at the age of 76. He was a member of the Society for 51 years.

Rafael Sanchez-Diaz, of Hollywood, Florida, died on January 19, 1990, at the age of 88. He was a member of the Society for 63 years.

James E. Skeath, of Swarthmore College, died on April 29, 1990, at the age of 53. He was a member of the Society for 28 years.

Visiting Mathematicians

(Supplementary List)

The list of visiting mathematicians includes both foreign mathematicians visiting in the United States and Canada, and Americans visiting abroad. Note that there are two separate lists.

American Mathematicians Visiting Abroad

Name and Home Country	Host Institution	Field of Special Interest	Period of Visit
Mislove, Michael (U.S.A.)	Oxford University	Domain Theory and Denotational Semantics	1/91 - 7/91
Park, Dong Ho (U.S.A.)	Pohang Institute, Korea	Statistics	8/90 - 5/91
Schulz, Friedmar (U.S.A.)	Australian National University	Partial Differential Equations	8/90 - 12/90

Visiting Foreign Mathematicians

Beltrametti, Mauro (Italy)	University of Notre Dame	Algebraic Geometry	8/90 - 5/91
Brodzki, Jacek (Poland)	University of Texas, Austin	Physics	9/90 - 5/91
Busque, Claudi (Spain)	University of Texas, Austin	Algebra	9/90 - 5/91
Chen, Yu (China)	University of Notre Dame	Algebra	8/90 - 1/91
Cheng, Chi-Lun (China)	University of Texas, Austin	Mathematics and Statistics	9/90 - 5/91
Colliot-Thelene, J.-L. (France)	Harvard University	Number Theory, Algebraic Geometry	2/91 - 6/91
Domanski, Wlodzimierz (Poland)	University of Nebraska-Lincoln	Applied Mathematics, PDE's	8/90 - 5/91
Drinfeld, Vladimir (U.S.S.R.)	Harvard University	Algebraic Geometry, Quantum Groups	2/91 - 6/91
Falcolini, Corrado (Italy)	University of Texas, Austin	Perterbation Theory	9/90 - 5/91
Herwig, Bernard (West Germany)	University of Notre Dame	Logic	8/90 - 5/91
Its, Alexander (U.S.S.R.)	Clarkson University	Integrable Systems	8/90 - 8/91
Kozniewski, Tadeusz (Poland)	University of Poland	Topology	8/90 - 5/91
Lomonosov, Viktor (U.S.S.R.)	Kent State University	Invariant Subspaces	3/90 - 6/91
Loos, Ottmar (Austria)	University of Ottawa	Jordan Pairs	9/90 - 11/90
Margulis, Gregorii (U.S.S.R.)	Harvard University	Ergodic Theory, Lie Group Theory	9/90 - 1/91
Mestre, Jean-Francoise (France)	Harvard University	Number Theory	9/90 - 1/91
Moriyoshi, Hitoshi (Japan)	SUNY at Buffalo	Topology and Geometry, K-theory	8/90 - 8/91
Reshetikhin, N. (U.S.S.R.)	Harvard University	Quantum Groups	7/90 - 6/93
Serre, J.-P. (France)	Harvard University	Number Theory	9/90 - 12/90
Tan, Weixin (China)	SUNY at Buffalo	Mathematical Physics	8/90 - 8/91
Traczyk, Pawel (Poland)	SUNY at Buffalo	Topology	8/90 - 8/91
Watling, Neil A. (United Kingdom)	SUNY at Buffalo	Operator Algebras	8/90 - 8/91
Zhou, Hao-Xuan (China)	SUNY at Buffalo	Topology	8/90 - 8/91

Reciprocity Agreements

The American Mathematical Society has "reciprocity agreements" with a number of mathematical organizations around the world. A current list appears below.

These Reciprocity Agreements provide for reduced dues for members of these organizations who choose to join the AMS and who reside outside of the U.S. and Canada. Reciprocally, members of the AMS who reside in the U.S. or Canada may join these organizations at a reduced rate. Summaries of the privileges available to AMS members who join under the terms of reciprocity agreements are given on the following pages. Members of these organizations who join the AMS as reciprocity members enjoy all the privileges available to ordinary members of the Society. AMS dues for reciprocity members are $44 for 1989 and $46 for 1990. Each organization was asked to review and update its listing in the Spring. An asterisk (*) after the name of an organization indicates that no response to this request had been received when the July/August *Notices* went to press. A disc (•) before the name of an organization indicates that application forms for that organization may be obtained by writing the American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02940.

Africa

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Asia

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Apply to: P. Srivastava, Secretary, Allahabad Mathematical Society, 10, C.S.P. Singh Marg, Allahabad-211 001, India.

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Privileges: Indian Journal of Mathematics.

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Indian Mathematical Society

Apply to: S. P. Arya, General Secretary, Indian Mathematical Society, Department of Mathematics, Maitreyi College, Bapu Dham Complex, Chanakyapuri, New Delhi 110 021, India.

Dues: $20; payable to M. K. Singal, Hon. Treasurer, IMS, Department of Mathematics, Meerut University, Meerut-250 005, India.

Privileges: *Mathematics Student.*

Officers: V. M. Shah (President), M. P. Singh (Immediate Past President), M. K. Singal (Treasurer), S. P. Arya (General Secretary), J. N. Kapur (Academic Secretary), I. B. S. Passi (Editor of *Journal of Indian Mathematical*

Society), A. M. Vaidya (Editor of *Mathematics Student*), K. S. Padmanabhan (Hony. Librarian).

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Apply to: Southeast Asian Mathematical Society, c/o Department of Mathematics, Chinese University of Hong Kong, Shatin, N.T., Hong Kong.

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Privileges: *SEAMS Newsletter, Southeast Asian Bulletin of Mathematics.*

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Apply to: H. M. Srivastava, Foreign Secretary, VPI, Department of Mathematics, University of Victoria, Victoria, British Columbia, Canada, V8W 2Y2 or R. C. Singh Chandel, Secretary, VPI, Department of Mathematics, D. V. Postgraduate College, Orai-285001, U. P., India.

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Address for mail: Reinhard Mennicken, University of Regensburg, D-8400 Regensburg, Federal Republic of Germany.

Apply to: R. Ansorge, Institut für Angewandte Mathematik, Universität, Hamburg, Bundesstr. 55, D-2000 Hamburg 13, Federal Republic of Germany.

Dues: 25.-DM; payable to J. Siekmann, FB 12 - Maschinentechnik, Universität - GHS Essen, Schützenbahn 70, D-4300 Essen, Federal Republic of Germany.

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Apply to: K. A. Lindsay, Glasgow Mathematical Association, Department of Mathematics, University of Glasgow, University Gardens, Glasgow G12 8QW, Scotland.

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Privileges: *Glasgow Mathematical Journal.*

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•Irish Mathematical Society

Address for mail: G. Ellis, Secretary, Mathematics Department, University College, Galway, Ireland.

Apply to: D. Tipple, IMS Treasurer, Department of Mathematics, University College, Dublin 4, Ireland.

Dues: US $10; payable to D. Tipple.

Privileges: Right to receive the *Bulletin of the Irish Mathematical Society*; right to subscribe to the *Proceedings of the Royal Irish Academy* (Section A) at a reduced rate.

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Dues: $10; payable to Íslenzka Stærðfræðafélagið.

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Apply to: Secretary General, J. Bolyai Mathematical Society, Anker Köz 1--3, Budapest, Hungary H-1061.

Dues: Are voluntary but should minimally cover duplication and mailing costs; Reciprocity members (residing outside Hungary) suggested fee is 1/8 of one percent of the member's net income; sponsoring members pay at least US $180 or equivalent per year.

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Dues: N.kr. 50 or N.kr. 500 for permanent membership; payable to Gerd Salter, Norsk Matematisk Forening.

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Privileges: *Butlettí de la Societat Catalana de Matemàtiques*, (2 numbers a year).

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Dues: $25; payable to Société Mathématique de Belgique, preferably by International Money Order, VISA, MasterCard, or American Express.

Privileges: *Bulletin de la Société Mathématique de Belgique* (6 numbers per year in 1989 and 1990). Series A and Series B, totalling about 800 pages.

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Address for mail: Société Mathématique de France, B.P. 126-05, F 75226 Paris, Cedex 05, France.

Apply to: Madame Janine Le Peintre, S.M.F., B.P. 126-05, F 75226 Paris, Cedex 05, France.

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Apply to: Société de Mathématiques Appliquées et Industrielles, Centre de Mathématiques Appliquées, École Polytechnique, 91128 Palaiseau, France.

Dues: US $25; Société de Mathématiques Appliquées et Industrielles.

Privileges: Free subscription to the *News Bulletin*, reduced rates at conferences organized by SMAI.

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Privileges: *Arkhimedes* (four issues a year) and *Eukleides* (newsletter).

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Dues: 40 Skr. or 1000 Skr. for permanent membership; payable to Svenska Matematikersamfundet, Ingegerd Palmér, Dept. of Mathematics, KTH, S-10066, Stockholm, Sweden.

Privileges: *Mathematica Scandinavica* and *Nordisk Matematisk Tidskrift* at reduced rate. Information about the meetings of the Society.

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Privileges: Free *Notiziario dell'UMI* (monthly), *Bollettino dell'UMI, ser. A* (3 issues a year), and membership list. Reduced fees for subscriptions to *Bollettino dell'UMI, Ser. B.* and discounts for other UMI publications.

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Apply to: Membership Department, Wiskundig Genootschap, University of Utrecht, Postbus 80010, 3508 TA Utrecht, The Netherlands.

Dues: Hfl 40.-; payable to Amro Bank, Utrecht, The Netherlands, Account 45.65.88.167, Penningmeester Wiskundig Genootschap.

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Privileges: *Boletim da SBM* (two issues per year); *Matématica Universitária* (two issues per year) at U.S. $20; *Ensaios* at U.S. $10 (each volume); other publications can be purchased at a 25% discount.

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Apply to: Secretary, Iranian Mathematical Society, P. O. Box 13145-418, Tehran, Iran.

Dues: $10; payable to Iranian Mathematical Society, M. Radjabalipour.

Privileges: *Bulletin of the Iranian Mathematical Society* and reduced rate for participation in the annual Iranian Mathematics conferences.

Officers: M. Toomanian (President-Secretary), M. Radjabalipour (Treasurer).

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Apply to: Israel Mathematical Union, c/o Abraham Berman, Secretary, Department of Mathematics, Technion-Israel Institute of Technology, Haifa 32000, Israel.

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Privileges: *Newsletter*; IMU-net, may attend and present papers at meetings.

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South Pacific

•Australian Mathematical Society

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Apply to: B. D. Jones, Department of Mathematics, University of Queensland, St. Lucia, Queensland 4067, Australia.

Dues: $A27.50; payable to B. D. Jones.

Privileges: Free copies of *The Gazette* and copies of *Journal Series A and B, The Bulletin* and the *Lecture Series* at members' rates.

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Apply to: Membership Committee, Mathematical Society of the Philippines, Department of Mathematics, Ateneo de Manila University, P.O. Box 154, Manila, Philippines.

Dues: $5; payable to Mathematical Society of the Philippines.

Privileges: Publications and newsletter of the Mathematical Society of the Philippines.

Officers: Jose Marasigan (President), Rene P. Felix (Vice-President), Aurora Trance (Treasurer), Rolando Ramos (Secretary).

•New Zealand Mathematical Society

Address for mail: Department of Mathematics and Statistics, Massey University, Palmerston North, New Zealand.

Apply to: K. L. Teo, Department of Mathematics and Statistics, Massey University, Palmerston North, New Zealand.

Dues: $NZ 15; payable to John A. Shanks, Department of Mathematics and Statistics, University of Otago, P.O. Box 56, Dunedin, New Zealand.

Privileges: *Newsletter of the NZMS* (3 per year); subscription to *Mathematical Chronicle* at reduced rate.

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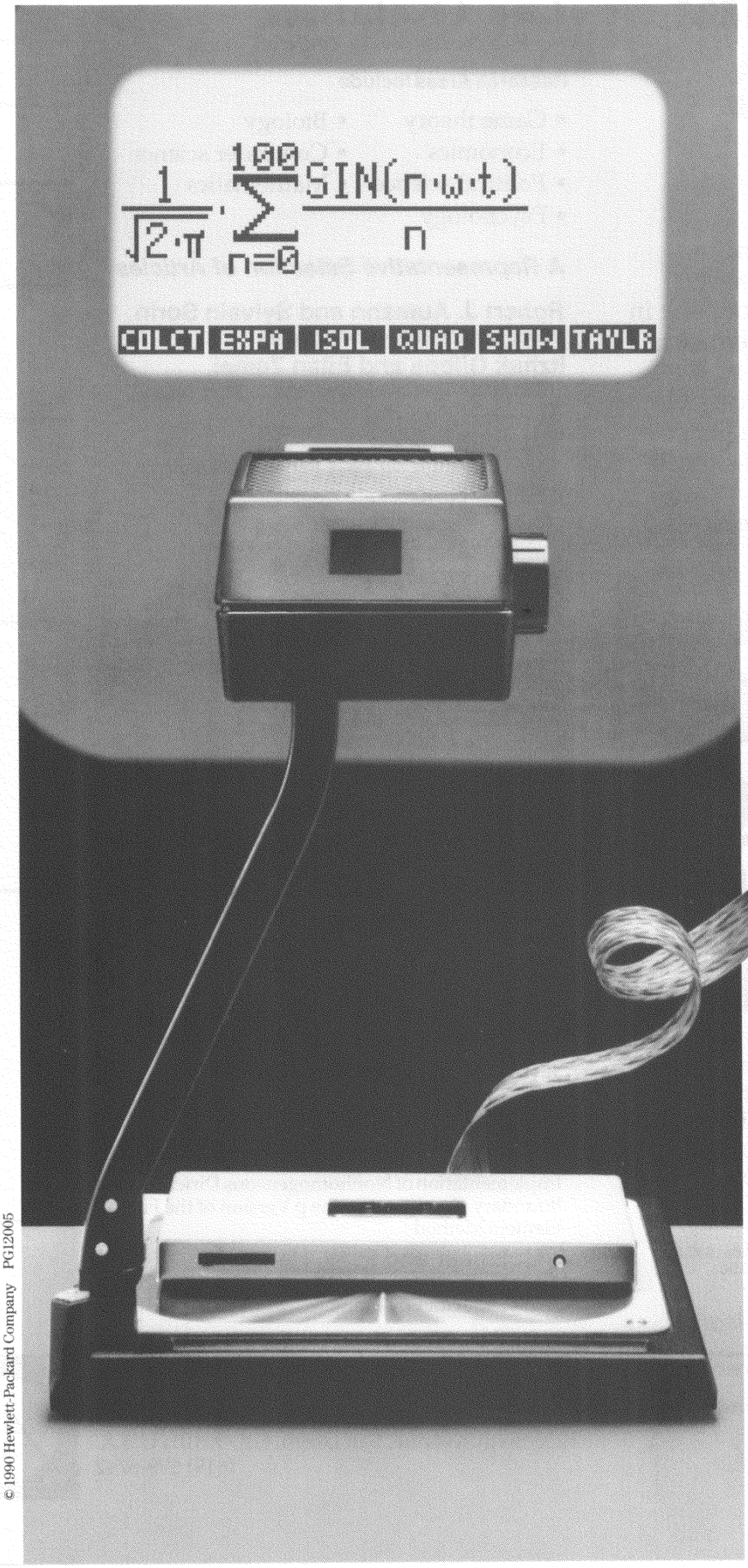

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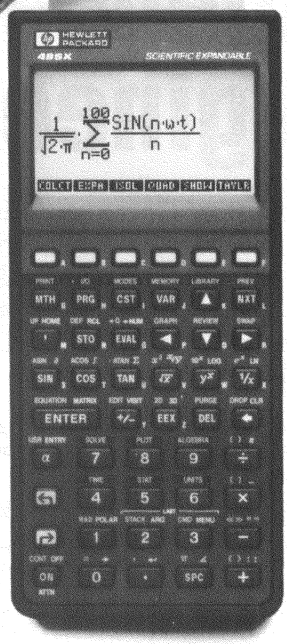

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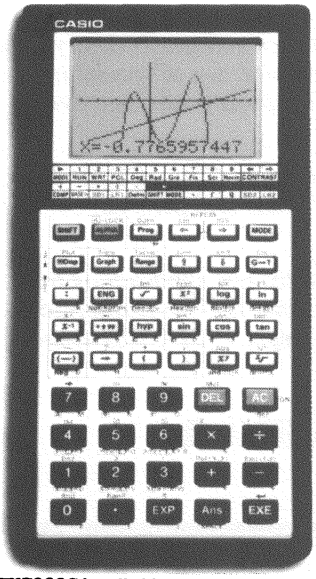

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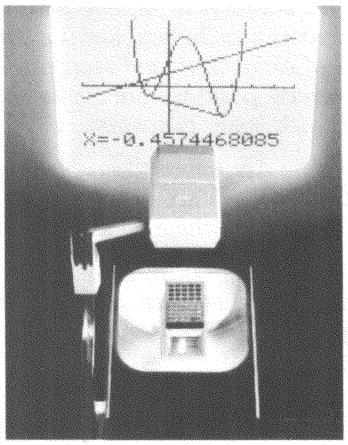

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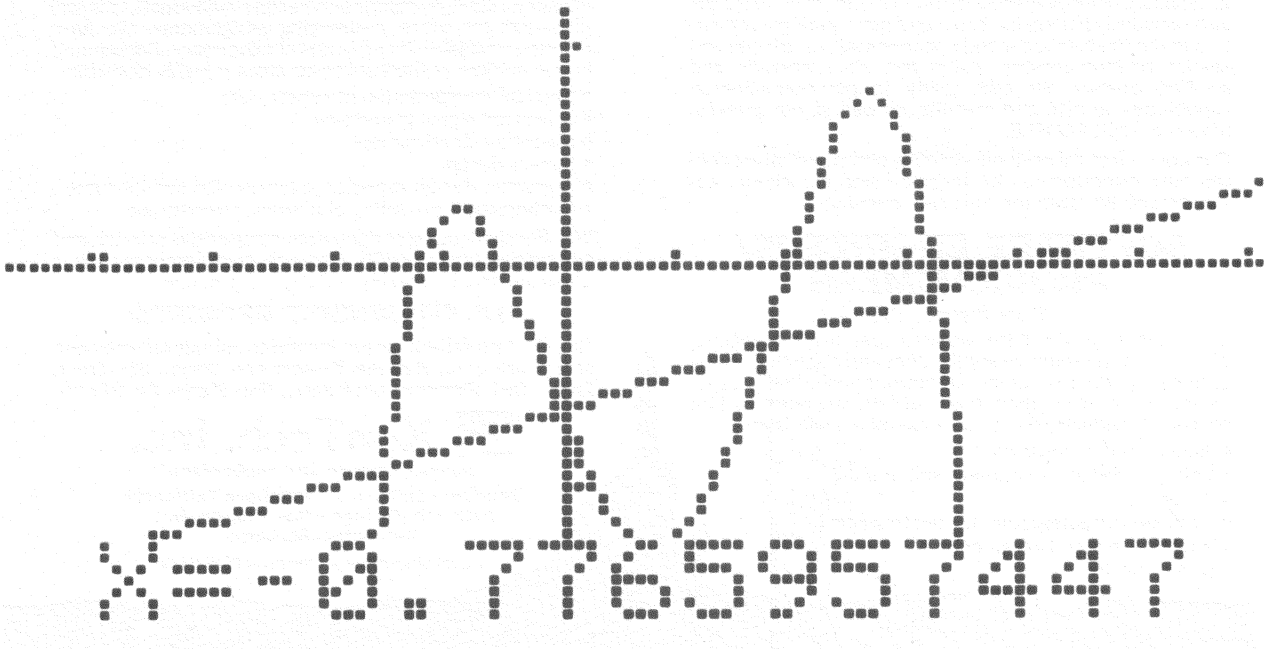

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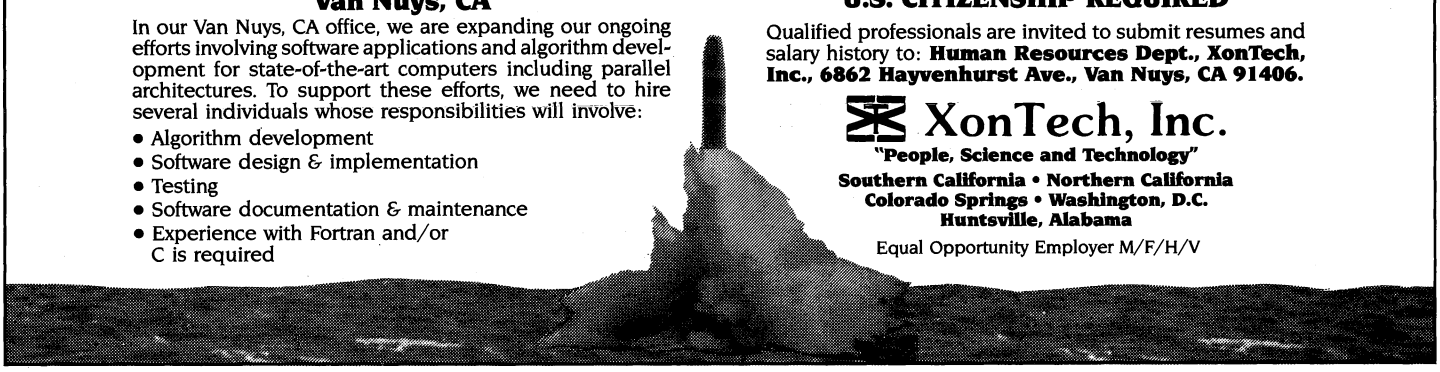

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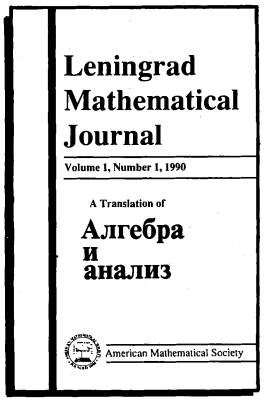

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The *Leningrad Mathematical Journal* is a cover-to-cover-translation into English of **Алгебра и анализ** , published by the mathematics section of the Academy of Sciences of the USSR via the Leningrad branch of "Nauka". With research papers, expository surveys, and book reviews, the *Leningrad Mathematical Journal* contains contributions by some of the most prominent Soviet mathematical scientists. Readers will appreciate this opportunity to keep abreast of Soviet developments in all areas of mathematics. The topics explored in the first issues range over a wide array of mathematical areas. A brief sampling includes: probability methods in the theory of conformal mappings, quantization of Lie groups and Lie algebras, almost cocommutative Hopf algebras, valence bonds in quasicrystals, the dynamics of analytic transformations, algebraic K-theory, and compact four-dimensional exotica.

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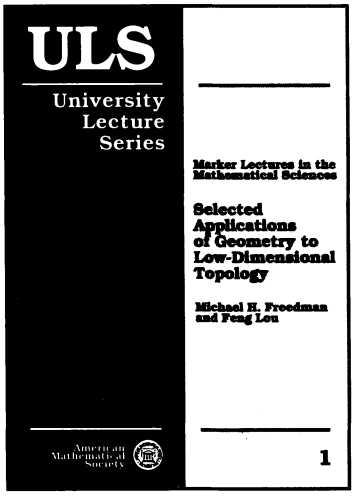
Michael H. Freedman and Feng Luo

(University Lecture Series, Volume 1)



This book, the inaugural volume in the new University Lecture Series, is based on lectures presented at Pennsylvania State University in February 1987. The Lectures attempt to give a taste of the accomplishments of manifold topology over the last 30 years. By the late 1950s, algebra and topology had produced a successful and beautiful fusion. Geometric methods and insight, now vitally important in topology, encompass analytic objects such as instantons and minimal surfaces, as well as nondifferentiable constructions.

Keeping technical details to a minimum, the authors lead the reader on a fascinating exploration of several developments in geometric topology. They begin with the notions of manifold and smooth structures and the Gauss-Bonnet theorem, and proceed to the topology and geometry of foliated 3-manifolds. They also explain, in terms of general position, why four-dimensional space has special attributes, and they examine the insight Donaldson theory brings. The book ends with a chapter on exotic structures on $\mathbf{R}^4$, with a discussion of the two competing theories of four-dimensional manifolds, one topological and one smooth.

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