CELEBRATE 100 YEARS OF AMERICAN MATHEMATICS

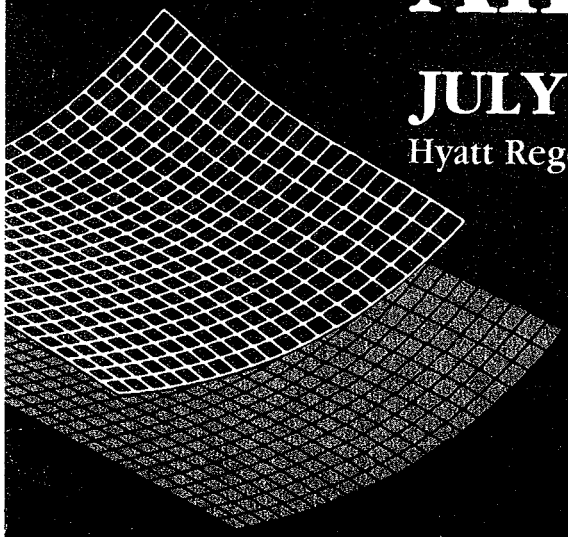
SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS

Preliminary Program

1988 SIAM Annual Meeting

JULY 11 – 15, 1988

Hyatt Regency Hotel, Minneapolis, Minnesota



And Short Course on Nonlinear Dynamics, Chaos, and Bifurcations

JULY 10, 1988

CONFERENCE THEMES

Computational Science
Chaotic Behavior and Nonlinear Systems
Computer Science
Signal Processing
Nonlinear Fluid Dynamics
Graph Theory
Image Compression
Parallel Processing
Materials Science
Numerical Analysis
Computer Impact on Mathematics
Mathematics of the Biological and Medical Sciences
Wave Propagation
Dynamical Systems and Fractals

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ORGANIZING COMMITTEE

LATE CONTRIBUTIONS

SIAM will accept late contributed presentations and poster presentations for this meeting. To make a contribution, please call or write for an abstract form to: Conference Coordinator, SIAM, 117 S. 17th Street, 14th Floor, Philadelphia, PA 19103. Telephone: (215) 564-2929. Contributions must be received by May 25th, in order to appear in the final program. SIAM will consider contributions until June 21st, but those received after May 25th, will be listed in an addendum to the final program based on the availability of both time and space.

SHORT COURSE

Short Course on Nonlinear Dynamics, Chaos, and Bifurcation
July 10, 1988
Hyatt Regency Hotel
Nicollet D-2

Scientists are now realizing that nonlinear dynamics has a wide variety of strange phenomena that are broadly applicable in virtually all realms of science. This series of tutorial lectures, presented by John Guckenheimer of Cornell University and James Yorke of the University of Maryland, will introduce some of these typical dynamical features and show their application to selected systems. The emphasis will be upon bifurcation—how asymptotic behavior of trajectories changes as parameters are varied in the definition of the system—and chaos—the occurrence of trajectories whose asymptotic behavior is aperiodic. The types of attractors which occur in systems: fixed, periodic, quasiperiodic, and chaotic will be described. The fractal structure of chaotic attractors and ways of quantifying it will be introduced. Bifurcation scenarios that portray the typical way that these attractors change will be discussed. Attention will be drawn to the routes to chaos, regular dynamics becomes chaotic, and to crises, bifurcations that signal dramatic changes in the basins of attraction. The role of symmetry in bifurcation theory will be introduced and discussed in relation to dynamical systems derived from partial differential equations.

There will be six hours of presentation plus discussion.

PROGRAM

9:00 AM	**Elementary Bifurcations of Dynamical Systems** John Guckenheimer
10:30 AM	Coffee and Discussion
11:00 AM	**Chaotic Dynamics** James A. Yorke
12:30 PM	Lunch and Discussion
2:00 PM	**Routes to Chaos** John Guckenheimer
3:30 PM	Coffee and Discussion
4:00 PM	**Fractal Dimension and Attractors** James A. Yorke
5:30 PM	Discussion
6:00 PM	Adjournment

Registration Fees*

	SIAM Member	Non Member	Student
Advance	$ 95	$115	$55
On-Site	$115	$135	$75

**Registration Fee for the Short Course includes preprints, coffee and lunch.*

Attendees should pre-register for the short course, as on-site registration cannot be guaranteed. Preprints of the lecture materials will be distributed upon check-in at the registration desk.

SPECIAL SESSIONS

THE JOHN VON NEUMANN LECTURE

Wednesday, July 13/2:00 PM
Chair: C. W. Gear
University of Illinois, Urbana-Champaign

Business and Pleasure with Stiff Differential Equations

Stiff initial value problems for ODE's are characterized by numerical instabilities that prevent the use of an explicit method with a step size that is commensurate with the global behavior of the solution. Typical examples are systems that describe simultaneous processes with widely differing time constants where some rapidly changing components tend to blend quickly with slower ones. Chemical kinetics offer many examples of this kind. But there are others, such as, for example, ODE systems that result when an initial value problem for a PDE is descretized in space. Singular perturbation problems also lead to stiff ODE's.

The search for accurate numerical methods with adequate stability properties leads to rather pleasant questions in classical analysis. In the 1960's the first general methods for stiff problems were developed and applied to problems that had defied solution by traditional methods. In these methods, the step size could sometime be increased successfully by several powers of 10, but at every step an algebraic system has to be solved by a modified Newton method that demands much storage and requires lots of computing time.

The speaker will address recent efforts in the search for alternative iterative techniques and describe the progress that has been made in finding various shortcuts that exploit the properties of systems found in important classes of applications.

Germund G. Dahlquist
Royal Institute of Technology
Stockholm, Sweden

ICEMAP Session

Monday, July 11/2:00 PM
Chair: Judith Sunley
National Science Foundation

ICEMAP (the Interagency Committee for Extramural Mathematics Programs) is a group that provides loose coordination of Federal funding for research in the mathematical sciences at academic institutions. This session is designed to inform attendees about the nature of support available (including anticipated budgets for the several agencies and types of awards for which one can compete); scientific areas of emphasis; and plans for the future. Questions from the audience are encouraged, particularly those concerned with issues relevant to the community as a whole. Representatives of the agencies will be available to talk with individuals about their particular concerns at various times during this meeting.

PROGRAM DESIGN: TOM JACKSON

SPECIAL SESSIONS

CENTENNIAL LECTURES

America celebrates 100 years of U.S. mathematics with a program of lectures designed to highlight a century of American mathematics inspired by real world problems.

Centennial Lecture 1
Tuesday, July 12/2:00 PM
Applied Mathematics and Scientific Computing: Pioneers, Puzzles, Prospects

During the past century, there have been remarkable developments in both applied mathematics and scientific computing, many of which were stimulated by seminal work of American mathematicians. The rapid development of large-scale digital computing over the past half century owes its genesis in large part to the work of mathematicians. The parallel development of numerical analysis and asymptotic methods, as well as their applications to continuum dynamics problems, have opened new vistas for science. All of these developments have had a profound impact on both the applied mathematics community in the United States industry, other disciplines, and society. The role of key individuals, including von Neumann, Gibbs, von Karman, Courant, and others, cannot be underestimated.

In this talk we shall trace some of the significant advances made in applied mathematical analysis, computational algorithms and computer design through the past century. We shall look at the crucial role played by several key pioneers in the development of these fields and see how they developed new approaches and techniques to solve the problems which faced them. The range of challenging puzzles presented by the diverse branches of applied mathematics and scientific computing in our own time will be described, and an attempt will be made to forecast the kinds of developments that will play an increasing role in the future.

Steven A. Orszag
Princeton University

Centennial Lecture 2
Wednesday, July 13/9:00 AM
The Emergence of Numerical Optimization

The mathematics problem area using up most of the world's computer time, according to a statement made by Lovasz in 1980, is numerical optimization. Business, industry, the space program—all depend heavily on mathematical models from linear programming, nonlinear programming, and control theory.

Continuous numerical optimization is an active, exciting, and large part of today's world of engineering and scientific computing. It affects our lives in many diverse ways.

The speaker will trace the historical development of numerical optimization and identify what we consider to be ideas and significant contributions. Our thesis will be that while the bulk of activity in numerical optimization has occurred in the period following the introduction of the simplex algorithm in the late 1940's, many of our contemporary tools, including the Karmarkar projective scaling transformation, have roots in the classical calculus of variations.

This close tie particularly befits the theme of "100 years of American Mathematics," since in the first part of the century, American mathematics contributed significantly to the theory of the calculus of variations, while in the last 30 years or so, American mathematics has played a major role in numerical optimization.

Richard Tapia
Rice University

Centennial Lecture 3
Thursday, July 14/2:00 PM
Mathematics and Signal Processing

Signal processing is an eclectic discipline, combining ideas and tools from, among others, signal analysis, system theory, statistics and numerical linear algebra, many branches of mathematics and computer science, and analog and digital technology to design and implement algorithms for a wide variety of applications. Though the tools range from the very old to the very new, most of the development of signal processing has taken place in this century, especially in the last few decades. Zobel and Campbell introduced selective wave filters for telephony in the early 1900's. Heaviside and Carson provided the analytical tools for linear system analysis in the next two decades, while Brune and Cauer laid the mathematical foundation for network synthesis in the 1930's. Norbert Wiener contributed to several of these early developments, but also introduced a powerful new direction with his work in the early 40's on the statistical theories of prediction and filtering. In the early 50's, Shannon's information theory held out hope for dramatic gains in downward compression and in reliable communication in noisy channels. In the 60's, the appearance of digital computers brought about a major revolution, releasing us from many prior limitations. Since then, there has been almost exponential growth in the field, many of the fruits of which are for example, almost common place today—the recovery of incredibly weak signals from outer space, high-speed communications over large computer networks and medical images of remarkable quality.

Although no one can cover this vast panorama in any reasonable number of presentations, in his presentation, the speaker will show how even simple problems of linear prediction can involve a rich and mutually fruitful blending of ideas from many fields, especially various kinds of mathematics.

Thomas Kailath
Stanford University

PRIZE PRESENTATIONS

Wednesday, July 13/3:00 PM

The George B. Dantzig Prize

The prize is awarded jointly by the Mathematical Programming Society (MPS) and SIAM. It is awarded for original work which by its breadth and scope constitutes an outstanding contribution to the field of mathematical programming.

The Dantzig Prize is awarded every three years and, while normally presented at the international Symposium of MPS, it will be awarded for the first time at a SIAM meeting.

The Richard C. DiPrima Prize

The Richard C. DiPrima Prize was established in 1986 to commemorate a former president of SIAM who also served for many years as a member of the SIAM Council and Board of Trustees, as Vice President for Programs, and as a dedicated and committed member.

The prize is awarded to a young scientist who has done outstanding research in applied mathematics and who has completed his/her doctoral dissertation and completed all other requirements for his/her doctorate during the period running from three years prior to the award date.

This will be the first award of this prize which is scheduled to be given every even year.

Mathematical Contest in Modeling

The SIAM-cosponsored Fourth Mathematical Contest in Modeling was held in February, with teams of three undergraduates devoting a weekend to modeling either of two applied problems. From among the teams judged outstanding, two SIAM graders selected one for a SIAM Award in special recognition of the quality of the team's solution. This award thus honors three students for excellence in collaborative mathematical modeling.

1988 SIAM ANNUAL BUSINESS MEETING

The annual business meeting of SIAM will be held on Wednesday, July 13th, at 3:30 PM in Nicollet Ballroom C-1.

This annual meeting is held for YOU, the members of SIAM, to afford you the opportunity to meet face-to-face with the officers you have elected to serve you. You will be apprised of SIAM's financial status, hear about our past successes, and be asked to participate in the future direction of our society.

This meeting will benefit all of us. We urge you to attend.

INVITED PRESENTATIONS

Monday, July 11/8:30 AM
Invited Presentation 1
Chaos, Strange Attractors, and Fractal Basin Boundaries in Nonlinear Dynamics

Even relatively simple deterministic systems can behave in an apparently unpredictable, erratic manner. This type of behavior is one of the attributes of chaotic dynamics. Within the last decade there has been an explosion of interest, and major developments have taken place in the field.

Examples of areas where chaotic dynamics have been applied or have impacted the scientific outlook include meteorology, ecology, fluid mechanics, chemistry, physics, engineering, economics, to name just a few. The common element in all of these fields is that they involve nonlinearity in some way. Indeed, chaos is expected to develop whenever nonlinearity plays a role. Since nonlinearity is inherent in so much of science and technology, an understanding of chaos is essential.

The speaker will present a review of the field of chaotic dynamics of dissipative systems, including recent developments. Topics to be covered include strange attractors, how chaos comes about with variation of a system parameter, universality, fractal basin boundaries and their effect on predictability, and applications to physical systems.

Celso Grebogi
University of Maryland, College Park

Monday, July 11/9:15 AM
Invited Presentation 2
The Mathematical Theory of the Crystallographic Phase Problem

The X-ray analysis of crystal structure may be viewed as an inverse problem in which the three-dimensional structure of a crystal is to be reconstructed from the results of an X-ray diffraction experiment. The intensities of the scattered beams which can be measured in such an experiment are essentially the squared moduli of the Fourier coefficients associated to the triply-periodic electron density distribution in the crystal. Unfortunately the corresponding phases cannot be measured, yet they must be restored by some means before the desired picture of the crystal structure can be obtained by Fourier synthesis. This constitutes the "Phase Problem" of X-ray crystallography.

Because of the extreme practical importance of its solution, the Phase Problem has been under constant attack for over half a century, but there is still no generally applicable method for solving it. Its recalcitrant nature derives from the fact that it is mathematically indeterminate unless sufficient chemical information is brought to bear on its solution to constrain it down to a reasonably unique answer, while the content of this chemical information cannot be adequately captured by any of the well-developed instruments of mathematics. The various techniques available at present to circumvent it all have their limitations, and are a constant source of difficulties.

The speaker will review the mathematical aspects of existing phase determination procedures, including some of his recent work on a Bayesian statistical theory of the Phase Problem aimed at providing a new solution strategy. He will also examine the computational requirements of present and foreseeable developments in this field, and in particular the design of superfast Fourier transform algorithms optimally adapted to crystallographic symmetry groups.

Gerard Bricogne
L.U.R.E. (Synchrotron Radiation Laboratory)
University of Paris, France

Tuesday, July 12/8:30 AM
Invited Presentation 3
Stability Analysis in Free Boundary Problems in Materials Science

For several decades, there has been an ever-intensifying interest by physical scientists and applied mathematicians in certain free boundary problems that arise in the context of materials science. These problems generally arise in the context of phase transformations and are generalizations of the classical Stefan problem in which one seeks to describe the position of the free, isothermal boundary that separates a pure crystal from its melt during solidification. In these generalized problems, the free boundary is no longer isothermal but, instead, has a temperature that depends on its local curvature (capillary effect due to surface tension). Moreover, for alloys, both thermal and solutal fields govern the process. Such problems are intrinsically two- or three-dimensional, and the shape of the boundary (not just its position) is paramount. From linear perturbation theory, it is known that such shapes are subject to instabilities, so-called morphological instabilities.

The speaker will discuss the manner in which both analytical and numerical techniques have been used to deepen an understanding of both steady-state and time-dependent shapes that occur in the nonlinear regime subsequent to morphological instability.

Robert F. Sekerka
Carnegie Mellon University

Tuesday, July 12/9:15 AM
Invited Presentation 4
3D Nonlinear Waves in Excitable Media—Modeling the Heart Muscle

So-called "excitable" media support nonlinear waves that propagate as pulses, e.g. the action potential in nerve fibers and heart muscle, and the oxidation pulse in the BZ reaction. In 2D media the right stimulus will also create points of singular phase, which become counter rotating sources for such pulses. Their investigation in diverse excitable media has dramatically expanded in the USA and USSR since their discovery in 1970.

In 3D media the phase singularity is not a point but a vortex line, generically a closed ring. Rings linked together and knotted constitute topologically distinctive organizing centers for periodic activity throughout the medium. In relation to the abrupt onset of turbulence (fibrillation) in healthy heart muscle, it is of interest to understand how stimuli create organizing centers, and how they persist or decay.

The speaker will illustrate organizing centers by 3D computer graphics, describe their taxonomy and anatomy in terms of topological theorems about surfaces and about phase maps, demonstrate their dynamics by vectorized numerical integration (or sometimes by approximate analytical solution) of partial differential equations of reaction and diffusion, and pose questions about the results in terms of differential geometry. (The foregoing techniques are all badly in need of refinement.)

Some of these puzzles have been solved but most still await attention. For example, the numerically discovered "stable" knots, twisted rings, and plain vortex rings exhibit enough symmetries to encourage mathematical attention. Results have immediate utility in experimental programs using a 3D, chemically excitable, medium and using real heart muscle. In both systems, ongoing laboratory experiments have already verified counterintuitive predictions, e.g. the existence of a phase in the cardiac cycle when the medium is vulnerable to turbulence through creation of mirror-paired vortex filaments (or a vortex ring) by a single stimulus, and the existence of an upper limit to stimulus size in the vulnerable zone.

Arthur T. Winfree
University of Arizona

Thursday, July 14/8:30 AM
Invited Presentation 5
Grand Challenges to Computational Science

Over the last four hundred years, scientists have learned how to design powerful scientific instruments like the microscope and telescope and to use them to make startling discoveries many orders of magnitude beyond the reach of the naked eye. The supercomputer is a new kind of scientific instrument with which the most spectacular discovery still lie very much in the future. Much attention is focussed now on how to complete the design of this new scientific instrument and learn how to use it so that scientific breakthroughs are achieved. An area of very major importance for supercomputing is algorithm development enabling the limited computational capability of today's supercomputers to generate accurate and reliable results for scientific problems of great complexity. Breakthroughs in traditional numerical analysis areas, like linear matrix operations, are not enough and collaborations between numerical analysts, and other mathematicians and scientists, will be needed to resolve the algorithmic bottlenecks. The speaker will discuss a number of scientific "grand challenge" areas where supercomputer in future will produce results fully as astonishing as the most powerful microscopes and telescopes once these algorithmic and other bottlenecks are resolved.

Kenneth G. Wilson
Cornell University

Thursday, July 14/9:15 AM
Invited Presentation 6
Solitons and Nonlinear Waves in Optics

Nonlinear optics is a relatively new subject because nontrivial interaction between light and matter requires large intensities over relatively narrow bands of frequency. This talk will survey the Maxwell-Bloch equations, the equations of motion for light-matter dynamics, and introduce some of the exciting new developments connected with nonlinear wave propagation in fibers and waveguides, Snell's laws in nonlinear dielectrics, optical bistability in ring and Fabry-Perot cavities, Raman and Brillouin scattering, four-wave mixing, phase conjugation, multimode and soliton lasers. One or two models will be discussed in detail. A key message is that optics provides a rich source of stimulating problems for the applied mathematician, problems that are intellectually challenging, technologically promising and, above all, problems that display the full spectrum of interesting behavior of nonlinear partial differential and difference equations.

Alan Newell
University of Arizona

MEETING HIGHLIGHTS

Friday, July 15/8:30 AM
Invited Presentation 7
Mathematical Problems Associated with the Elasticity of Fluids

Flow and processing of viscoelastic liquids are the foundation of huge industries. But the mathematical properties that characterize the flow of these liquids are only beginning to be understood. The speaker will focus on the elastic properties of the viscoelastic liquids by expanding on an old idea of Poisson and Maxwell that all liquids are ultimately elastic when the deformations are sufficiently rapid. Mathematically, the equations give rise to propagation of waves of vorticity and to steady "transonic" vorticity fields, just as in gas dynamics. In these vorticity fields, molecules adjust to new conditions by relaxing at different rates, the smaller molecules more quickly than the larger ones. The elephants never forget. The faster relaxations give rise to a viscous environment in which the slower, elastic, relaxations stay 'alive'. This produces a mix of wave behavior (hyperbolicity) and diffusion (parabolicity) not well understood mathematically because it does not fit into the standard classification. The speaker will show how their ideas manifest themselves in nature and will discuss the implications of mathematical structure for some problems that occur in numerical simulations of processing flows.

Daniel D. Joseph
University of Minnesota, Minneapolis

Friday, July 15/9:15 AM
Invited Presentation 8
Adaptive Computational Methods

Difficulties in numerical approximation and finding the physically important domains in the solution of a problem usually coalesce in the same subregion of solution space. Typically, the space-time coordinates are the independent variables while the solution state space is described by dependent variables. Adaptive computations balance the computational effort, in either space, by working harder where the answer is more difficult and/or the answer is more important.

The independent variables are represented by a grid and adaptivity for them refers to adaptive grid construction. This can be accomplished by a choice of nonuniform grid spacings or by use of refined grids inserted into or overlapping with a primary uniform grid. Multigrid methods should be viewed as adaptive also, with the localization of computational effort occurring in wave number space or momentum variables conjugate under Fourier Transform to space variables. State space variables also allow localized consideration, as in the case with nonlinear waves, eigenmodes, rate-limiting chemical reactions and the equilibrium treatment which eliminates (undesirable) transients in rapid solution modes.

The speaker will demonstrate representative grid and state space adaptive methods, together with illustrations showing the use of these methods in practical examples.

James G. Glimm
Courant Institute of Mathematical Sciences
New York University

MINISYMPOSIA

1. **Mathematical Aspects of Computational Image Analysis**
   Donald E. McClure, Brown University
2. **Mathematical Models of Phase Transition and Growth Phenomena In Statistical Physics and Materials Science 1**
   Francis Sullivan, National Bureau of Standards
3. **Mathematical Epidemiology**
   Carl P. Simon, University of Michigan, Ann Arbor
4. **Chaotic Dynamics and Fractals**
   Michael F. Barnsley, Georgia Institute of Technology
5. **Combinatorial Optimization**
   Clyde Monma, Bell Communications Research
6. **Performance Evaluation and Benchmarking**
   Jack J. Dongarra, Argonne National Laboratory
7. **Material Science and Applied Mathematics**
   R. Tao, Northeastern University
8. **How The Computer Will Influence Mathematics**
   Richard McGehee, University of Minnesota, Minneapolis
9. **Mathematical Models Of Phase Transition And Growth Phenomena In Statistical Physics And Material Science 2**
   Geoffrey McFadden, National Bureau of Standards
10. **Computational Methods For Nonlinear Reaction, Diffusion, Convection Systems Of Partial Differential Equations**
    Joseph Jerome, Northwestern University
11. **Waves In Elastic-Plastic Solids**
    John A. Trangenstein, Lawrence Livermore National Laboratory
12. **New Directions For The Shannon Sampling Theorem**
    Gilbert G. Walter, University of Wisconsin, Milwaukee
13. **Numerical Grid Generation; Mathematical Aspects—1**
    Stanly Steinberg, University of New Mexico
14. **Nonlinear Oscillations and Excitability In Cell Physiology**
    John Rinzel, National Institutes of Health
15. **Mathematics and Applications of Inverse Problems and Imaging**
    Mostafa Kaveh, University of Minnesota, Minneapolis
16. **Computer Aided Proofs In Analysis**
    Kenneth R. Meyer, University of Cincinnati
17. **(Title and chair to be announced in final program)**
18. **1988 Mathematical Contest In Modeling, Including SIAM-Award Winners**
    James Daniel, University of Texas, Austin
19. **Expander Graphs And Their Applications**
    Joel Friedman, Princeton University
20. **Parallel Processing, Distributed Computing And Economics**
    Stanley Reiter, Northwestern University
21. **p and h-p Versions Of Finite Element Methods In Computational Solid Mechanics**
    Soren Jensen, University of Maryland, Baltimore County
22. **Splitting Methods In Wave Propagation Problems**
    Robert J. Krueger, Iowa State University
23. **Zero-Crossings and Nonuniform Sampling Of Signals And Systems**
    Farokh Marvasti, Illinois Institute of Technology
24. **Numerical Grid Generation; Mathematical Aspects 2**
    Jose E. Castillo, San Diego State University
25. **Spectral Methods In Computational Fluid Mechanics**
    Soren Jensen, University of Maryland, Baltimore County
26. **Theoretical, Experimental, and Computational Aspects of Viscous, Free-Surface Flows**
    W. G. Pritchard, Pennsylvania State University
27. **Association Schemes**
    Dennis W. Stanton, University of Minnesota, Minneapolis
28. **Applications Of Asymptotic Techniques To Stochastic Problems**
    James McKenna, AT&T Bell Laboratories
29. **Bringing MACSYMA Into The Mainstream Of Applied Mathematics**
    Richard Petti, Symbolics, Inc.
30. **Numerical Device And Process Modeling For VLSI Systems**
    William M. Coughran, Jr., AT&T Bell Laboratories
31. **Algorithms For The Algebraic Eigenvalue Problem On Parallel Architectures**
    Patricia J. Eberlein, SUNY Buffalo
32. **Theory And Computational Of Defects In Continuous Media**
    David Kinderlehrer, University of Minnesota, Minneapolis
33. **(Title and chair to be announced in final program)**

SPECIAL EVENTS

Welcoming Reception
Sunday, July 10, 8:00 PM–10:00 PM
Nicollet D1-D2
Cash bar

Beer Party
Monday, July 11, 6:00 PM–8:00 PM
Exhibit Hall

The beer party will consist of pizza, baked potato skins with choice of toppings, beer and assorted sodas. Cost $15.00

Buffet Dinner and Mississippi River Boat Cruise
Wednesday, July 13, 6:30 PM–9:30 PM
Boom Island, Minneapolis, MN

Enjoy a relaxing river cruise and buffet dinner aboard the Anson Northrup River Boat. The old fashion side wheeler will cruise through the locks of St. Anthony's Falls and down the Mississippi River between the twin cities of St. Paul and Minneapolis. We will also cruise by the Old Showboat Landing at the University of Minnesota and the wood cliffs along the river banks.

Between 6:30 PM and 7:30 PM enjoy a cocktail at one of the two full service bars on board the Anson Northrup where you can purchase the cocktail of your choice. At 7:30 PM we will be seated for a buffet dinner consisting of both baked breast of chicken and prime filet mignon, assorted salads, vegetables, baked potato and an assortment of desserts. There will also be red and white wine served with dinner. Buses will leave the hotel lobby at 5:45 PM.
Cost $28.00

PREPRINTS TABLE

SIAM has reserved a table in the book exhibit area for those attendees who wish to share new results or ideas with other participants at the meeting. We encourage you to bring copies of your work to the meeting and make them available to those who may be interested. No advertisements or promotions, please.

PROGRAM-AT-A-GLANCE

Saturday, July 9/PM

5:00 PM/Nicollet Promenade
Registration opens for Short Course

9:00 PM/Nicollet Promenade
Registration closes

Sunday, July 10/AM

8:00 AM/Nicollet Promenade
Registration opens for Short Course

9:00 AM/Nicollet D-2
Elementary Bifurcations of Dynamical Systems
John Guckenheimer
Cornell University

10:30 AM/Nicolett D-1
Coffee

11:00 AM/Nicollet D-2
Chaotic Dynamics
James A. Yorke
University of Maryland, College Park

Sunday, July 10/PM

12:30 PM/Nicollet B-1 and C-1
Lunch

2:00 PM/Nicollet D-2
Routes to Chaos
John Guckenheimer
Cornell University

3:30 PM/Nicollet D-1
Coffee

4:00 PM/Nicollet D-2
Fractal Dimensions and Attractors
James A. Yorke
University of Maryland, College Park

5:30 PM/Nicollet D-2
Discussion

6:00 PM
Short Course adjourns

6:00 PM
Registration opens for Meeting

8:00 PM/Nicollet D-1 and D-2
Welcoming Reception

9:00 PM/Nicollet Promenade
Registration closes

Monday, July 11/AM

7:15 AM/Nicollet Promenade
Registration opens

8:15 AM/Nicollet C-1
Opening Remarks

8:30 AM/Nicollet C-1
Invited Presentations 1 and 2
Chair: Donald G. Saari
Northwestern University

8:30 AM
Chaos, Strange Attractors, and Fractal Basin Boundaries in Nonlinear Dynamics
Celso Grebogi
University of Maryland, College Park

9:15 AM
The Mathematical Theory of the Crystallographic Phase Problem
Gerard Bricogne
University of Paris, France

10:00 AM/Exhibit Hall
Coffee

10:30 AM
CONCURRENT SESSIONS

Minisymposium 1/Nicollet D-2
Mathematical Aspects of Computational Image Analysis
Chair: Donald E. McClure
Brown University

Minisymposium 2/Nicollet C-1
Mathematical Models of Phase Transition and Growth Phenomena in Statistical Physics and Materials Science 1
Chair: Francis Sullivan
National Bureau of Standards

Minisymposium 3/Nicollet D-3
Mathematical Epidemiology
Chair: Carl S. Simon
University of Michigan, Ann Arbor

Contributed Presentations 1/Greenway B
Theory of Partial Differential Equations

Contributed Presentations 2/Greenway A
Finite Element Techniques

Contributed Presentations 3/Nicollet D-1
Optimization and Control

Monday, July 11/PM

12:30 PM
Lunch

2:00 PM/Nicollet C-1
ICEMAP Session (the Interagency Committee for Extramural Mathematics Programs)
Chair: Judith S. Sunley
National Science Foundation

3:00 PM/Exhibit Hall
Coffee

3:30 PM
CONCURRENT SESSIONS

Minisymposium 4/Nicollet D-3
Chaotic Dynamics and Fractals
Chair: Michael Barnsley
Georgia Institute of Technology

Minisymposium 5/Nicollet D-2
Combinatorial Optimization
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
Chair: Clyde Monma
Bell Communications Research

Minisymposium 6/Nicollet C-1
Performance Evaluation and Benchmarking
(Sponsored by the SIAM Activity Group on Supercomputing)
Chair: Jack Dongarra
Argonne National Laboratory

Minisymposium 7/Nicollet D-1
Materials Science and Applied Mathematics
Chair: R. Tao
Northeastern University

Contributed Presentations 4/Greenway C
Analysis 1

Contributed Presentations 5/Greenway A
Matrices and Linear Algebra

Contributed Presentations 6/Greenway B
Mathematics in Medicine

6:00 PM/Exhibit Hall
Beer Party

PROGRAM-AT-A-GLANCE

Tuesday, July 12/AM

8:30 AM/Nicollet C-1
Invited Presentations 3 and 4
Chair: Francis Sullivan
National Bureau of Standards

8:30 AM
Stability Analysis in Free Boundry Problems in Materials Science
Robert F. Sekerka
Carnegie Mellon University

9:15 AM
3d Nonlinear Waves in Excitable Media—Modeling the Heart Muscle
Arthur T. Winfree
University of Arizona

10:00 AM/Exhibit Hall
Coffee

10:30 AM
CONCURRENT SESSIONS

Minisymposium 8/Nicollet D-2
How the Computer will Influence Mathematics
Chair: Richard McGehee
University of Minnesota, Minneapolis

Minisymposium 9/Nicollet C-1
Mathematical Models of Phase Transition and Growth Phenomena in Statistical Physics and Materials Science 2
Chair: Geoffrey McFadden
National Bureau of Standards

Minisymposium 10/Nicollet D-3
Computational Methods for Nonlinear Reaction, Diffusion, Convection Systems of Partial Differential Equations
Chair: Joseph Jerome
Northwestern University

Contributed Presentations 7/Greenway A
Materials Science

Contributed Presentations 8/Nicollet D-1
Signal Processing and Data Analysis

Contributed Presentations 9/Greenway B
Free Surface Problems

Tuesday, July 12/PM

12:30 PM
Lunch

2:00 PM/Nicollet C-1
Centennial Lecture 1
Applied Mathematics and Scientific Computing: Pioneers, Puzzles, Prospects
Steven Orszag
Princeton University

3:00 PM/Exhibit Hall
Coffee

3:30 PM
CONCURRENT SESSIONS

Minisymposium 11/Nicollet C-1
Waves in Elastic-Plastic Solids
Chair: John A. Trangenstein
Lawrence Livermore National Laboratory

Minisymposium 12/Nicollet D-2
New Directions for the Shannon Sampling Theorem
Chair: Gilbert G. Walter
University of Wisconsin, Milwaukee

Minisymposium 13/Nicollet D-3
Numerical Grid Generation: Mathematical Aspects 1
Chair: Stanly Steinberg
University of New Mexico

Minisymposium 14/Nicollet D-1
Nonlinear Oscillations and Excitability in Cell Physiology
Chair: John Rinzel
National Institutes of Health

Contributed Presentations 10/Greenway B
Analysis 2

Contributed Presentations 11/Greenway A
Parallel Algorithms

Poster Session 1/Exhibit Hall

Wednesday, July 13/AM

9:00 AM/Nicollet C-1
Centennial Lecture 2
The Emergence of Numerical Optimization
Richard Tapia
Rice University

10:00 AM/Exhibit Hall
Coffee

10:30 AM
CONCURRENT SESSIONS

Minisymposium 15/Nicollet D-3
Mathematics and Applications of Inverse Problems and Imaging
Chair: Mostafa Kaveh
University of Minnesota, Minneapolis

Minisymposium 16/Nicollet C-1
Computer Aided Proofs in Analysis
Chair: Kenneth R. Meyer
University of Cincinnati

Minisymposium 17/Nicollet D-2
(Title and chair to be announced in final program)

Minisymposium 18/Nicollet D-1
1988 Mathematical Contest in Modeling, Including SIAM Award Winners
(Sponsored by the SIAM Vice President for College and University Activities)
Chair: James Daniel
University of Texas, Austin

Contributed Presentations 12/Greenway B
General Session

Contributed Presentations 13/Greenway A
Mathematics in Biology

Poster Session 2/Exhibit Hall

Wednesday, July 13/PM

12:30/PM
Lunch

2:00 PM/Nicollet C-1
The John von Neumann Lecture
Business and Pleasure with Stiff Differential Equations
Germund G. Dahlquist
Royal Institute of Technology, Sweden

3:00 PM/Nicollet C-1
Prize Presentations
The George B. Dantzig Prize
The Richard C. DiPrima Prize
The 1988 Mathematical Contest in Modeling Award

3:30 PM/Nicollet C-1
1988 SIAM Business Meeting

5:30 PM/Hotel Lobby
Buses leave for Mississippi River Boat Cruise and Dinner

PROGRAM-AT-A-GLANCE

Thursday, July 14/AM

8:30 AM/Nicollet C-1
Invited Presentations 5 and 6
Chair: Williard Miller, Jr.
University of Minnesota

8:30 AM
Grand Challenges to Computational Sciences
Kenneth G. Wilson
Cornell University

9:15 AM
Solitons and Nonlinear Waves in Optics
Alan Newell
University of Arizona

10:00 AM/Exhibit Hall
Coffee

10:30 AM
CONCURRENT SESSIONS

Minisymposium 19/Nicollet D-3
Expander Graphs and Their Applications
Chair: Joel Friedman
Princeton University

Minisymposium 20/Nicollet D-2
Parallel Processing, Distributed Computing and Economics
Chair: Stanley Reiter
Northwestern University

Minisymposium 21/Nicollet C-1
p and h-p Versions of Finite Element Methods in Computational Solid Mechanics
Chair: Soren Jensen
University of Maryland, Baltimore County

Contributed Presentations 14/Greenway A
Fluid Flow and Heat Transfer 1

Contributed Presentations 15/Greenway B
Reaction-Diffusion and Heat Conduction

Contributed Presentations 16/Nicollet D-1
Wave Propagation 1

Thursday, July 14/PM

12:30 PM
Lunch

2:00 PM/Nicollet C-1
Centennial Lecture 3
Mathematics and Signal Processing
Thomas Kailath
Stanford University

3:00 PM/Exhibit Hall
Coffee

3:30 PM
CONCURRENT SESSIONS

Minisymposium 22/Nicollet D-1
Splitting Methods in Wave Propagation Problems
Chair: Robert J. Krueger
Iowa State University

Minisymposium 23/Nicollet D-3
Zero-Crossing and Nonuniform Sampling of Signals and Systems
Chair: Farokh Marvasti
Illinois Institute of Technology

Minisymposium 24/Nicollet D-2
Numerical Grid Generation: Mathematical Aspects 2
Chair: Jose E. Castillo
San Diego State University

Minisymposium 25/Nicollet C-1
Spectral Methods in Computational Fluid Mechanics
Chair: Soren Jensen
University of Maryland, Baltimore County

Contributed Presentations 17/Greenway A
Numerical Analysis (Algebra)

Contributed Presentations 18/Greenway B
Dynamical Systems and Chaos

Contributed Presentations 19/Greenway C
Mechanics, Optics, Electromagnetism

Friday, July 15/AM

8:30 AM/Nicollet C-1
Invited Presentations 7 and 8
Chair: Joseph W. Jerome
Northwestern University

8:30 AM
Mathematical Problems Associated with the Elasticity of Fluids
Daniel Joseph
University of Minnesota, Minneapolis

9:15 AM
Adaptive Computational Methods
James G. Glimm
Courant Institute of Mathematical Sciences
New York University

10:00 AM/Exhibit Hall
Coffee

10:30 AM
CONCURRENT SESSIONS

Minisymposium 26/Nicollet D-2
Theoretical, Experimental, and Computational Aspects of Viscous, Free-Surface Flows
Chair: W. G. Pritchard
Pennsylvania State University

Minisymposium 27/Nicollet D-1
Association Schemes
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
Chair: Dennis Stanton
University of Minnesota, Minneapolis

Minisymposium 28/Nicollet C-1
Applications of Asymptotic Techniques to Stochastic Problems
Chair: James McKenna
AT&T Bell Laboratories

Minisymposium 29/Nicollet D-3
Bringing MACSYMA into the Mainstream of Applied Mathematics
Chair: Richard Petti
Symbolics, Inc.

Contributed Presentations 20/Greenway B
Domain Decomposition and Grid Methods

Contributed Presentations 21/Greenway A
Applied Geometry and Fractals

Contributed Presentations 22/Greenway C
Ordinary Differential Equations

Friday, July 15/PM

12:30 PM
Lunch

2:00 PM
CONCURRENT SESSIONS

Minisymposium 3/Nicollet D-2
Numerical Device and Process Modeling for VLSI Systems
Chair: William M. Coughran, Jr.
AT&T Bell Laboratories

Minisymposium 31/Nicollet C-1
Algorithms for the Algebraic Eigenvalue Problem on Parallel Architectures
Chair: Patricia J. Eberlein
SUNY Buffalo

Minisymposium 32/Nicollet D-3
Theory and Computation of Defects in Continuous Media
Chair: David Kinderlehrer
University of Minnesota, Minneapolis

Minisymposium 33/Nicollet D-1
(Title and Chair to be announced in final program)

Contributed Presentations 23/Greenway A
Numerical Analysis (PDEs)

Contributed Presentations 24/Greenway C
Fluid Flow and Heat Transfer 2

Contributed Presentations 25/Greenway B
Wave Propagation 2

4:00 PM Meeting Adjourns

MINISYMPOSIA

Monday, July 11/10:30 AM
Minisymposium 1/Nicollet D-2

MATHEMATICAL ASPECTS OF COMPUTATIONAL IMAGE ANALYSIS

The goals of computer methods for analyzing digital pictures range from "low level" image processing (for example, image restoration) to "high level" problems in scene analysis and computer vision (for example, invariant recognition of objects). Increasingly, the methods and algorithms for performing these analyses are guided by mathematical concepts and models. Recently, connectionist models (neural networks) and Markov random fields have been prominent in this context. In return, the problems of image processing and computer vision are stimulating the development of new mathematics, for example, to better understand the behavior of algorithms for global optimization of objective functions on very high-dimensional domains. In this minisymposium, we will highlight selected interactions between mathematics and applications to image analysis.

Organizer: **Donald E. McClure**
Brown University

A Relational Approach in Object Recognition
Elie Bienenstock
Universite' Paris-Sud, France

Asymptotic Behavior of Simulated Annealing
Chii-Ruey Hwang
Academia Sinica, Taiwan

Recursive Stochastic Minimization Algorithms
Sanjoy K. Mitter, Massachusetts Institute of Technology; and **Saul B. Gelfand**, Purdue University, West Lafayette

Monday, July 11/10:30 AM
Minisymposium 2/Nicollet C-1

MATHEMATICAL MODELS OF PHASE TRANSITION AND GROWTH PHENOMENA IN STATISTICAL PHYSICS AND MATERIALS SCIENCE—I

Phase transition and growth phenomena occur in many real-world applications, including alloy solidification and domain separation. Associated mathematical problems provide fascinating instances of successful modeling using Monte Carlo methods and nonlinear pde's, and of the use of large-scale computations to gain new insights into physical and mathematical questions. Among recent results is the remarkable discovery that the same growth law is obtained from several seemingly completely different mathematical and computational models. This minisymposium will include a discussion of various approaches and the relations among them. There will also be reports of recent theoretical and computational work on related problems.

Organizers: **Francis Sullivan** (Chair) and **Geoffrey McFadden**, National Bureau of Standards, Gaithersburg, MD

Monte Carlo Study of Spinodal Decomposition in the Two-Dimensional Kinetic Ising Model
Jacques Amar
National Bureau of Standards, Gaithersburg, MD

Domain Growth and Remanent Magnitization Decay in Spin Glasses
David Huse
AT&T Bell Laboratories

Numerical Simulation of Morphological Development During Ostwald Ripening
Geoffrey McFadden
National Bureau of Standards, Gaithersburg, MD

Ostwald Ripening in Systems Which Transform by the Transport of Heat and Mass
Peter W. Voorhees
Northwestern University

Stress Coarsening
William C. Johnson
Carnegie-Mellon University

Monday, July 11/10:30 AM
Minisymposium 3/Nicollet D-3

MATHEMATICAL EPIDEMIOLOGY

Mathematical models of the dynamics of the spread of diseases have led to a better understanding of how biological and sociological mechanisms influence disease spread, to more effective comparisons among communicable diseases, to the performance of theoretical experiments in an area where actual experiments are not possible for ethical and practical reasons, and top predictions of the relative merits of different control methods. In some cases, mathematical models have led to successful immunization strategies. On the other hand, as the speakers in this session will show, the models in epidemiology have led to interesting mathematical problems and results in stability, periodicity, structure, and chaotic behavior of dynamical systems.

Organizer: **Carl P. Simon**
University of Michigan, Ann Arbor

Dynamic Models in Mathematics and Economics
(To be presented by the Organizer)

Periodicity in Epidemiological Models
Herbert W. Hethcote, University of Iowa, Iowa City; and Simon A. Levin, Cornell University

Delays and Age Structure in Models of the Spread of AIDS
Kenneth L. Cooke
Pomona College

The Case for Chaos in Childhood Epidemics
William M. Schaffer, and G. L. Truty, University of Arizona, Tucson

Monday, July 11/3:30 PM
Minisymposium 4/Nicolett D-3

CHAOTIC DYNAMICS AND FRACTALS

Randomness, chaotic dynamics, and fractal geometry are related to one another. The relationship between these leads to new mathematical tools for analyzing experimental data and to new parallel algorithms for the analysis and computation of images.

Organizer: **Michael F. Barnsley**
Georgia Institute of Technology

Mixing Computer Images which are Generated from Orbits of 2-D Markov Chains
Marc A. Berger
The Weizmann Institute of Science
Israel

Thermodynamic Formalism for Fully Turbulent Flows
Katepalli Sreenivasan
Yale University

Sufficiency as Statistical Symmetry
Persi Diaconis
The Science Center, Cambridge, MA

Recurrent Iterated Function Systems
Michael F. Barnsley and John Elton, Georgia Institute of Technology

Monday, July 11/3:30 PM
Minisymposium 5/Nicollet D-2

COMBINATORIAL OPTIMIZATION

(Sponsored by the SIAM Activity Group on Discrete Mathematics)

In recent years there have been several exciting new developments in the area of combinatorial optimization which bring to bear the tools of mathematics, computer science and operations research. The talks in this session focus on three such areas: (1) New methods for solving linear programming problems; (2) Polyhedral combinatorics for solving large-scale combinatorial problems; and (3) Combining mathematical programming approaches and computational geometry to solve new optimization problems.

Organizer: **Clyde Monma**
Bell Communications Research

On Maximum Flows in Polyhedral Domains
Joseph S. B. Mitchell
Cornell University

Solving Large O-1 Linear Programming Problems: Some Recent Results
Karla L. Hoffman
George Mason University

A Primal-Dual Interior Point Method for Linear Programming
(To be presented by the Organizer)

The Nonlinear Geometry of Linear Programming
David Bayer
Columbia University

Monday, July 11/3:30 PM
Minisymposium 6/Nicollet C-1

PERFORMANCE EVALUATION AND BENCHMARKING

(Sponsored by the SIAM Activity Group on Supercomputing)

Computing power is now a crucial part of many facets of research and engineering. From desktop workstations to supercomputers, scientists rely on computers for their everyday work. But measuring the performance of those computers is an imprecise art at best. The performance of a computer is a function of many interrelated quantities. There is no single approach to evaluation that addresses the requirements of all the communities involved in computer measurement. There is no universal metric of value. This minisymposium will examine the topic of performance evaluation and benchmarking.

Organizer: **Jack J. Dongarra**
Argonne National Laboratory

Computing Performance in Resource Limited Environments
Kirk Jordan
Exxon Research and Engineering Company

Measuring Performance of Parallel Computers
Francis Sullivan
National Bureau of Standards, Gaithersburg, MD

Supercomputer Performance Evaluation
Joanne Martin
IBM Corporation

The Livermore Fortran Kernels Test
Frank McMahon
Lawrence Livermore National Laboratory

MINISYMPOSIA

Monday, July 11/3:30 PM
Minisymposium 7/Nicollet D-1

MATERIALS SCIENCE AND APPLIED MATHEMATICS

This minisymposium offers a survey of recent advances in material sciences as they pertain to applied mathematics. Computer simulations have produced a tremendous impact on material science research. Two speakers will discuss this aspect and present their research results from computer simulation in this field. Meanwhile, people are still looking for analytical solution of physical models. One speaker will discuss his new model and his mathematical techniques. There is a general belief that non-relativistic quantum mechanics is sufficient in material science. However, the recent study of new materials, magneto crystals, shows that only relativistic quantum electrodynamics can explain them. One speaker will discuss this issue for us.

Organizer: **R. Tao**
Northeastern University

Polarization of Charge Density Waves
J. B. Sokoloff, Northeastern University; and I. Webman, IBM Bergen Scientific Centre, Norway

Thermal Properties of Fractals
(To be presented by the Organizer)

Energetics of a Discrete Interface
Qiwei Zhang
Courant Institute of Mathematical Sciences, New York University

Quantum Electrodynamic Aspects of Magneto-Electric Crystals
A. Widom, and Y. Srivastava, Northeastern University

Tuesday, July 12/10:30 AM
Minisymposium 8/Nicollet D-2

HOW THE COMPUTER WILL INFLUENCE MATHEMATICS

Computers are profoundly influencing the ways in which some mathematicians are doing mathematics. Numerical simulations of differential equations have traditionally been the major use of computers in mathematical investigations, but the situation is changing. The use of algebraic manipulators is spreading rapidly. The future promises computer-assisted proofs of theorems; indeed, the early stages have been with us for some time. This minisymposium brings together mathematicians from diverse fields who will describe how they use the computer in their research.

Organizer: **Richard McGehee**
University of Minnesota, Minneapolis

Minimal Surfaces
Frederick Almgren
Princeton University

(title to be announced)
Dennis Hejhal
University of Minnesota, Minneapolis

Solving Ordinary Differential Equations Symbolically by Computer
Dieter Schmidt
University of Cincinnati

Answering Open Questions with an Automated Reasoning System
Larry Wos
Argonne National Laboratory

Tuesday, July 12/10:30 AM
Minisymposium 9/Nicollet C-1

MATHEMATICAL MODELS OF PHASE TRANSITION AND GROWTH PHENOMENA IN STATISTICAL PHYSICS AND MATERIALS SCIENCE—II

Phase transition and growth phenomena occur in many real-world applications, including alloy solidification and domain separation. Associated mathematical problems provide fascinating instances of successful modeling using Monte Carlo Methods and nonlinear pde's, and of the use of large-scale computations to gain new insights into physical and mathematical questions. Among recent results is the remarkable discovery that the same growth law is obtained from several seemingly completely different mathematical and computational models. This minisymposium will include a discussion of various approaches and the relations among them. There will also be reports of recent theoretical and computational work on related problems.

Organizers: **Geoffrey McFadden (Chair)** and **Francis Sullivan**, National Bureau of Standards, Gaithersburg, MD

Field Theory for Growth Kinetics
Gene F. Mazenko
The University of Chicago

Domain Growth in Both the Kinetic Ising and Continuum Langevin Models
J. D. Gunton
Temple University

Scaling in Ordering at Surfaces: Prospects for Experimental Observation
Ted Einstein
University of Maryland, College Park

A General Geometric Model of Coarsening: Mathematical Development—I
Steven Marsh
Rensselaer Polytechnic Institute

A General Geometric Model of Coarsening: Mathematical Development—II
Daniel Zwillinger
The MITRE Corporation, Bedford, MA

Models for Two Solution Crystal Growth Problems
Joseph Fehribach
University of Alabama, Huntsville

Tuesday, July 12/10:30 AM
Minisymposium 10/Nicollet D-3

COMPUTATIONAL METHODS FOR NONLINEAR REACTION, DIFFUSION, CONVECTION SYSTEMS OF PARTIAL DIFFERENTIAL EQUATIONS

Models of biodegradation, petroleum reservoir recovery, and semiconductor simulation are included among the many physical and biological models leading to reaction/diffusion/convection systems of partial differential equations. These systems are characterized by a potential equation for the ambient force field, and conservation equations for the carrier concentrations. Such systems emerge as highly convective, and require numerical methods which reflect this. In recent years, algorithms based on mixed finite element methods, approximate characteristics, and Newton/continuation calculus have been introduced. Some of these models and ideas will be discussed in this minisymposium.

Organizer: **Joseph Jerome**
Northwestern University

Simulation of Flow in Naturalli Fractured Reservoirs
Jim Douglas, Jr.
Purdue University

(Titles to be announced)
Joseph Jerome, Northwestern University; and Mary F. Wheeler, Rice University

Tuesday, July 12/3:30 PM
Minisymposium 11/Nicollet C-1

WAVES IN ELASTIC-PLASTIC SOLIDS

The study of waves in elastic-plastic solids is important in a number of applications, such as flow of granular materials, highspeed impact of metals and the design of structures threatened by earthquakes. Plastic yielding leads to a discontinuity of the momentum flux derivative that introduces discontinuities into the characteristic wave structure. Because these discontinuities lead to a variety of very interesting physical effects, the speakers in this minisymposium will present several views of the subject. One of them will discuss conditions under which the flow of granular materials becomes ill-posed; this phenomenon is often associated with shear-banding. Another speaker will present models of the dependence of stress on the strain rate during high-speed loading in metals. Since the solution of Riemann problems is an important step in several numerical methods (such as the random choice method front-tracking and Godunov's method), one of the talks will discuss an analysis of the Riemann problem for von Mises plasticity in metals. The fourth speaker will discuss a characteristic analysis of finite deformation in hypoelastic-plastic solids with thermal effects, in order to apply the higher-order Godunov method, together with an approximate Riemann-problem solver.

Organizer: John A. Trangenstein
Lawrence Livermore National Laboratory

Ill-Posedness in the Critical State Theory for Granular Media
E. Bruce Pitman
New Jersey Institute of Technology

Shock Wave Plasticity: Theory and Experimental Results
Davis Loel Tonks
Los Alamos National Laboratory

The Riemann Problem for Elastic-Plastic Solids
James E. Hammerberg, and Charles H. Neil, Los Alamos National Laboratory

Characteristic Structure of Finite Deformation in Elastic-Plastic Solids
(To be presented by the Organizer)

MINISYMPOSIA

Tuesday, July 12/3:30 PM
Minisymposium 12/Nicolett D-2

NEW DIRECTIONS FOR THE SHANNON SAMPLING THEOREM

The original Shannon sampling theorem enables one to recover a (π) band limited signal with finite energy from its values on the integers. A number of extensions have been introduced. These include (i) versions of the theorem applicable to bandlimited signals with infinite energy, (ii) versions with irregular sampling points, (iii) versions with several time like variables, (iv) versions appropriate for signals which are not bandlimited, (v) stochastic version, and (vi) combinations of (i)—(v). In this minisymposium we hope to present a sampling of recent discoveries in these extensions.

Organizers: **Gilbert G. Walter** (Chair), University of Wisconsin, Milwaukee; and **Ahmed Zayed**, California Polytechnic State University

Prediction Formulas Based on Samples of Bandlimited Signal and Its Derivative
Dale H. Mugler
Santa Clara University

Lagrange-Type Interpolation Associated With Kramer's and Shannon's Sampling Theorems
A. Zayed, California Polytechnic State University; **G. Hinsen** and **P. Butzer**, Technischen Hochschule Aachen, W. Germany

Nonuniform Sampling Expansions of Two-Dimensional Bandlimited Signals
P. Butzer, and **G. Hinsen**, Technischen Hochschule Aachen, W. Germany

A Sampling Theorem for Jacobi Transforms
Gilbert G. Walter
University of Wisconsin, Milwaukee

Tuesday, July 12/3:30 PM
Minisymposium 13/Nicolett D-3

NUMERICAL GRID GENERATION; MATHEMATICAL ASPECTS—I

Numerical grid generation is one of the most important aspects in the numerical solution of partial differential equations on irregular geometries. This topic is of considerable interest to anyone involved in the numerical modeling of complex phenomena, particularly those interested in numerical fluid dynamics. The speakers will address some of the aspects of these methods in order to obtain a better understanding how they work and what their limitations are.

Organizers: **Jose Castillo**, San Diego State University; and **Stanly Steinberg** (Chair), University of New Mexico

Volume Integral in Grid Generation
Jose E. Castillo
San Diego State University

Elliptic Grid Generation and Conformal Mapping
C. Wayne Mastin
Mississippi State University

Adaptive Grid Generation
Peter Eiseman
Columbia University

General Theory of Transformations
Philip Smith
IMSL, Houston

Tuesday, July 12/3:30 PM
Minisymposium 14/Nicollet D-1

NONLINEAR OSCILLATIONS AND EXCITABILITY IN CELL PHYSIOLOGY

Electrical activity plays an important role in the physiological function of various biological cells (neurons, muscle cells, secretory cells . . .). Such activity frequently involves nonlinear dissipative phenomena, which may be oscillatory, e.g. the cyclic signaling by nerve networks to simulate muscles for locomotion, or excitable as in the generation of individual nerve impulses for superthreshold conditions. The physiological function often requires the coordination or recruitment of many cells and thereby entails coupling and propagation mechanisms. The mathematical models involve nonlinear ordinary and partial differential equations. These speakers will describe the models from a biophysical vantage point, indicate some of the interesting mathematical problems and techniques which arise, and illustrate the valuable role which modeling has played in understanding how the electrical activity is generated, coordinated, and propagated.

Organizer: **John Rinzel**
National Institutes of Health

Emergence of Bursting Oscillations in Coupled Insulin-Secreting Cells
Arthur Sherman and **John Rinzel**, National Institutes of Health; and **Joel Keizer**, University of California, Davis

Coupled Neural Oscillators
G. Bard Ermentrout
University of Pittsburgh

Slow Passage Through a Hopf Bifurcation: A Memory Effect and Its Dependence on Fluctuations
Steven M. Baer
National Institutes of Health

Behavior of Models of Myelineated Axons
Jonathan Bell
SUNY, Buffalo

Wednesday, July 13/10:30 AM
Minisymposium 15/Nicollet D-3

MATHEMATICS AND APPLICATIONS OF INVERSE PROBLEMS AND IMAGING

Many imaging techniques, particularly those that involve tomographic reconstruction, solve the inverse problem of a multidimensional source-medium interaction model. Physical considerations for the generation of the measured data are used in the inversion process to determine (image) the unknown parameters of the postulated model. The speakers in this minisymposium will discuss the theory and applications of inversion in the context of a variety of tomographic imaging problems. Physical model validation, approximations for practical inversion and the accompanying computational issues will be addressed.

Organizer: **Mostafa Kaveh**
University of Minnesota, Minneapolis

Comparison of Received Signals Predicted by Diffraction Tomography and Measured by Experiment
James F. Greenleaf, and **Aloysius Chu**
Mayo Clinic

Partially Coherent Emission Tomography
A. J. Devaney
A. J. Devaney & Associates, Ridgefield, CT

Image Reconstruction by Inversion of the Exact Helmholtz Wave Equation
S. Johnson
University of Utah, Salt Lake City

Tomographic Methods for Geophysical Inversion
B. Levy, and **A. Ozbeck**
University of California, Davis

Wednesday, July 13/10:30 AM
Minisymposium 16/Nicollet C-1

COMPUTER AIDED PROOFS IN ANALYSIS

More and more, the computer is being used to prove theorems in such traditional mathematical disciplines as analysis. Two approaches are represented in this minisymposium. The first is the use of floating point calculations with a careful error analysis to establish a rigorous result and the second is to use exact rational arithmetic.

Organizer: **Kenneth R. Meyer**
University of Cincinnati

Stability and Bifurcation Proofs Via Computers
(To be presented by the Organizer)

Do Computer Trajectories of Chaotic Systems Represent True Trajectories?
James A. Yorke
University of Maryland, College Park

Bifurcation of Critical Periods for Plane Vector Fields
Carmen C. Chicone, and **Marc Jacobs**
University of Missouri, Columbia

Computer-Assisted Proofs in Mathematical Physics
R. De La Llave
Princeton University

Wednesday, July 13/10:30 AM
Minisymposium 17/Nicollet D-2

(Titles and speakers to be announced in final program)

Wednesday, July 13/10:30 AM
Minisymposium 18/Nicollet D-1

1988 MATHEMATICAL CONTEST IN MODELING, INCLUDING SIAM-AWARD WINNERS

(Sponsored by the SIAM Vice President for College and University Activities)

SIAM co-sponsors the annual Mathematical Contest in Modeling (MCM), in which teams of three undergraduates develop a mathematical model of an applied problem; teams may devote an entire weekend to the problem, the model, and its analysis, using computers and libraries.

Two SIAM graders selected a SIAM-Award winning team to present its solution in this minisymposium; other excellent solutions will be presented, along with information on the contest itself.

This minisymposium provides an opportunity for SIAM members to recognize outstanding future applied mathematicians and to learn how to stimulate student participation on the MCM at their own institution.

Organizer: **James Daniel**
University of Texas, Austin

An Introduction to the Mathematical Contest in Modeling
Ben Fusaro
U.S. Military Academy, and Salisbury State College

Solution to a Contest Problem
SIAM Award Winning Teams (3 to be selected)

MINISYMPOSIA

Thursday, July 14/10:30 AM
Minisymposium 19/Nicollet D-3

EXPANDER GRAPHS AND THEIR APPLICATIONS

(Sponsored by the SIAM Activity Group on Discrete Mathematics)

Expander graphs, roughly speaking, are graphs which for every subset of vertices, A, of a given size, the size of the set of neighbors of A is at least a constant factor greater than A's. Expansion is useful, for example, to prevent congestion in a communication network; networks whose underlying graph is an expander that can be used for efficient packet routing or telephone communication. Expanders are of theoretical interest because no explicit constructions of optimal expanders are known. One can give (non-explicit) counting arguments to prove the existence of graphs of fixed degree with a certain amount of expansion, but the best known explicit constructions are not known to have as good expansion factors.

Organizer: **Joel Friedman**
Princeton University

Expanders: An Overview
(To be presented by the Organizer)

Quasi-Random Graphs
Fan R. K. Chung
Bell Communications Research

The Second Eigenvalue of Random Regular Graphs
André Broder
D.E.C. Systems Research Center, Palo Alto

Eigenvalues and Graph Bisection Problems
Ravi Boppana
Rutgers University

Thursday, July 14/10:30 AM
Minisymposium 20/Nicollet D-2

PARALLEL PROCESSING, DISTRIBUTED COMPUTING AND ECONOMICS

Efficient allocation of resources among economic agents requires coordinated action (organizational performance) and depends on information initially dispersed among the agents. The problem is analogous to one of distributed computing, with "agents" = "processors", "initial information" = "distributed data", and "coordinated action" = "value of the function to be computed". Relations between organizational performance, time of computation, and amount of communication required are explored in this minisymposium. Several of the speakers will discuss tradeoffs between the number of (discrete) variables communicated and the accuracy of the computation of the desired action, when the problem is to verify in a decentralized way that a proposed action is the desired one. Other speakers will present study dynamic computational processes for finding desired actions and the study tradeoffs between communication requirements and the time of computations, in one case, and issues of convergence and stability in another.

Organizer: **Stanley Reiter**
Northwestern University

Message Capacity Requirements for Approximate Parallel Verification
Leonid Hurwicz, University of Minnesota, Minneapolis; and **T. Marschak**, University of California, Berkeley

Decentralized Stochastic Adjustment Processes
James P. Jordan
University of Minnesota, Minneapolis

Economic Organization and Distributed Computing
(To be presented by the Organizer)

Computational Complexity and Economics
Daniel J. Kleitnan
Massachusetts Institute of Technology

Thursday, July 14/10:30 AM
Minisymposium 21/Nicollet C-1

p and h-p VERSIONS OF FINITE ELEMENT METHODS IN COMPUTATIONAL SOLID MECHANICS

The focus of this minisymposium will be extension procedures of the finite element method as applied to solid mechanics. With the p-version the mesh is fixed and higher accuracy is achieved by increasing the polynomial degree p. The h-p version allows in addition mesh refinement. This is the first of two minisymposia on this subject. The second minisymposium is entitled: "Spectral Methods in Computational Fluid Mechanics."

The four speakers will present the latest advances in this very active field, citing numerous collaborations between researchers in mathematics, engineering, and industry. Both theoretical and computational aspects will be touched.

Organizer: **Soren Jensen**
University of Maryland, Baltimore County

Mathematics of the h-p Version of the Finite Element Method
Ivo Babuska
University of Maryland, College Park

Industrial Experience with the p-Version of the Finite Element Method
Barna A. Szabo
Washington University, St. Louis

PROBE-3D Analysis of Solid Structures by the p-Version of the FEM
D. A. Dunavant, and **Joseph L. Baudrexl**, Noetic Technologies Corporation, St. Louis, MO

Reliability, Accuracy and Computational Efficiency of a Self-Adaptive Finite Element Scheme for Solution of Problems in Three-Dimensional Elastomechanics
Borje Andersson, **Urban Falk** and **Anders Gustavsson**, The Aeronautical Research Institute of Sweden

Thursday, July 14/3:30 PM
Minisymposium 22/Nicollet D-1

SPLITTING METHODS IN WAVE PROPAGATION PROBLEMS

Wave splitting techniques are being used increasingly as a method for studying propagation and inverse problems. The technique amounts to the introduction of a new basis for the problem such that the dynamics are re-expressed in terms of quantities which are readily observed or controlled, or quantities which are of more fundamental interest or more easily computed than the field variables themselves. In any given problem there may be several appropriate choices of splittings depending on the motivation for studying the problem. In this minisymposium, a number of different wave splitting philosophies and techniques will be presented. These techniques will be applied to vector and/or multidimensional direct and inverse scattering problems, as well as problems involving the exact or approximate determination of fields in a medium.

Organizers: **Robert J. Krueger (Chair)**, Iowa State University; and **Vaughan H. Weston**, Purdue University, West Lafayette

Splitting Methods for Wave Equations
James Corones
Iowa State University

Phase Space Factorization and Functional Integral Methods in Direct and Inverse Scattering
Louis Fishman
Colorado School of Mines

Splitting and Parabolic Approximation Methods for Surface Water Wave Propagation
Vijay G. Panchang
University of Maine, Orono

Wave Splitting and Inverse Scattering for the Wave Equation in IR^3
Vaughan H. Weston
Purdue University, West Lafayette

Thursday, July 14/3:30 PM
Minisymposium 23/Nicollet D-3

ZERO-CROSSINGS AND NONUNIFORM SAMPLING OF SIGNALS AND SYSTEMS

This minisymposium offers a survey of zero-crossings and nonuniform sampling of signals and systems with emphasis on the synergy of the two for developing theorems and reconstruction methods. Recent developments in the analysis of single and multidimensional signals, and theorems related to zero-crossings and nonuniform samples will be discussed. Other topics will be spectral estimation, and partial information that can be derived from zero-crossings of one and two-dimensional signals. Related topics, such as reconstruction of two-dimensional signals from a finite number of nonuniform samples by minimizing maximum mean squared error, and some iterative techniques will be discussed by the organizer.

Organizer: **Farokh Marvasti**
Illinois Institute of Technology

Multiple Level Crossings and Reconstruction Schemes for Multi-Dimensional Signals
Avida Zaqoush, and **Allen Oppenheim**, Massachusetts Institute of Technology

Higher Order Crossings (HOC) Processes
Benjamin Kedem
University of Maryland, College Park

Time-Sequential Sampling of Time-Varying Multidimensional Signals with an Application to Motion Estimation
Jan P. Allebach, and **Mohammed Rahgozar**, Purdue University, West Lafayette

Reconstruction of Two-Dimensional Signals From Nonuniform Samples
(To be presented by the Organizer)

MINISYMPOSIA

Thursday, July 14/3:30 PM
Minisymposium 24/Nicollet D-2

NUMERICAL GRID GENERATION; MATHEMATICAL —II

Numerical grid generation is one of the most important aspects in the numerical solution of partial differential equations on irregular geometries. This topic is of considerable interest to anyone involved in the numerical modeling of complex phenomena, particularly those interested in numerical fluid dynamics. The speakers will address some of the aspects of these methods in order to obtain a better understanding of how they work and what their limitations are.

Organizers: **Jose E. Castillo (Chair),** San Diego State University; and **Stanly Steinberg,** University of New Mexico

Grid Generation on Curves and Surfaces
Stanly Steinberg, University of New Mexico, and Patrick J. Roache, Ecodynamic Research Associate

Harmonic Maps in Grid Generation
Arkady Dvinsky
Creare Incorporated, Hanover, NH

Variational Surface Grid Generation
J. Saltzman
Los Alamos National Laboratory

Surface Grid Generation and Differential Geometry
Z. U. A. Warsi
Mississippi State University

Thursday, July 14/3:30 PM
Minisymposium 25/Nicollet C-1

SPECTRAL METHODS IN COMPUTATIONAL FLUID MECHANICS

This minisymposium will focus on spectral approaches of computational fluid mechanics within the framework of pseudo-spectral techniques and spectral elements. It complements the minisymposium: "p and h-p Versions of Finite Element Methods in Computational Solid Mechanics. Both minisymposia deal with the determination of a numerical solution of an (initial), boundary value problem in terms of truncated series of known (piecewise) smooth functions. The four speakers will review the most recent progresses done in a very active field with theoretical and computational aspects of the numerical solution of Stokes and Navier-Stokes equations.

Organizers: **Soren Jensen**
University of Maryland, Baltimore County

Spectral Element Methods for the Incompressible Navier-Stokes Equations
Paul F. Fischer, Lee-Wing Ho, Cathy Mavriplis, Einar M. Ronquist, and Anthony T. Patera, Massachusetts Institute of Technology

High-Order Finite-Element Methods for the Stokes Equations in Three Dimensions
Ridgway Scott
Pennsylvania State University

The $IP_N \times IP_{N-2}$ Spectral Element Approximation of the Stokes and Navier-Stokes Equations
Y. Maday, Universite de Paris Val de Marne and Universite Pierre et Marie Curie, France; A. Patera and E. M. Ronquist, Massachusetts Institute of Technology

Spectral Collocation Methods for Solution of Problems on Incompressible and Compressible Transition
Michele G. Macaraeg, Craig L. Streett, NASA Langley Research Center; and M. Yousuff Hussaini, ICASE

Friday, July 15/10:30 AM
Minisymposium 26/Nicollet D-2

THEORETICAL, EXPERIMENTAL, AND COMPUTATIONAL ASPECTS OF VISCOUS, FREE-SURFACE FLOWS

Scientific issues centering on viscous free-surface flows arise in many contexts, including laying of emulsion on film, aspect of oil recovery, and the design of dies for the extrusion of materials, to mention only a few. The subject has been strongly influenced by experimental work which has led to the discovery of unexpected phenomena, some of which will be featured. Theoretical and developmental aspects of numerical simulation of such flows will also be discussed. These computations are an important tool which relates both to the experimental situations and to analytical discovery. The study of the mathematical problems thrown up by this class of flows is in its infancy, but some results for a simple flow arising in one of the experiments will also be presented.

Organizers: **W. G. Pritchard (Chair)**
and **J. L. Bona,** Pennsylvania State University

A Technique for Determining the Boundary Conditions at the Intersection of a Free Surface with a Solid Wall
E. B. Dussan, Schlumberger-Doll Research Center; E. Ramé, University of Pennsylvania; and S. Garoff, Schlumberger-Doll Research Center

Computational and Experimental Comparisons of a Perturbed Poiseville-Nusselt Flow
Simon J. Tavener
Pennsylvania State University

Free Boundary Problem for Perturbation of Poiseville-Nusselt Flow
Frederick Abergel
Pennsylvania State University

Stability of Coating Flows
K. N. Christodoulou and L. E. Scriven
University of Minnesota, Minneapolis

Analysis of Numerical Methods for Flows with a Free Boundary
Ridgway Scott
Pennsylvania State University

Experiments on the Flow of Two Immisscible Liquids
Daniel D. Joseph
University of Minnesota, Minneapolis

Friday, July 15/10:30 AM
Minisymposium 27/Nicollet D-1

ASSOCIATION SCHEMES

(Sponsored by the SIAM Activity Group on Discrete Mathematics)

Several aspects of association schemes will be surveyed. One type of association scheme is a distance regular graph. Recent work on the classification of these graphs will be discussed. There are also classical orthogonal polynomials associated with the graphs, and combinatorial ramifications of their analytic properties will be given. Another type of association scheme occurs from a multiplicity free permutation representation of a finite group. These representations will be discussed, including the appropriate geometry on the coset spaces.

Organizer: **Dennis W. Stanton**
University of Minnesota, Minneapolis

The Classification of P and Q Polynomial Association Schemes
Paul Terwilliger
University of Wisconsin, Madison

Character Tables of Association Schemes
Eiichi Bannai
Ohio State University, Columbus

Orthogonal Polynomials of Classical Association Schemes
(To be presented by the Organizer)

S-Transitive and Distance Transitive Graphs
Richard Weiss
Tufts University

Friday, July 15/10:30 AM
Minisymposium 28/Nicollet C-1

APPLICATIONS OF ASYMPTOTIC TECHNIQUES TO STOCHASTIC PROBLEMS

For many stochastic models, exact analytic solutions are either impossible to obtain or are extremely difficult to evaluate. In some cases the quantities of interest can be characterized as the solutions of boundary value problems governed by differential or difference equations. Often highly accurate approximate solutions to such problems can be obtained by the use of asymptotic techniques.

Many queueing systems can be characterized by a parameter, that lies between zero and one. Approximate solutions can be obtained when this parameter is either near zero or one. When the parameter is near one the resulting approximation is referred to as the diffusion approximation. Although correction terms to the leading order term are generally unknown, in some situations higher order terms can be obtained.

Recently useful and important approximate solutions have been obtained by very different techniques when the parameter is near zero. New results in this area will be presented. Finally, there are models for which exact solutions exist. Such solutions are extremely difficult to evaluate when some of the parameters become large, but special techniques have proved useful in this case.

Organizers: **James McKenna (Chair),** AT&T Bell Laboratories; and **Bernard J. Matkowsky,** Northwestern University

Applications of Singular Perturbation Techniques in Queueing Theory
Bernard J. Matkowsky
Northwestern University

Light Traffic Expansions for Analysis, Design, and Control of Queueing Systems
Martin I. Reiman
AT&T Bell Laboratories

Some Topics in Diffusion Approximations
Charles Knessl
University of Illinois, Chicago

A New Tree Algorithm for Calculating the Partition Function of Some Large Closed Product-Form Queueing Networks
James McKenna
AT&T Bell Laboratories

MINISYMPOSIA

Friday, July 15/10:30 AM
Minisymposium 29/Nicollet D-3

BRINGING MACSYMA INTO THE MAINSTREAM OF APPLIED MATHEMATICS

Just as computers revolutionalized numerical analysis, they are now revolutionizing symbolic mathematics, yielding enormous increases in speed, accuracy and modeling power. Improved software technology, plus plunging hardware costs, are thrusting the technology into the mainstream of applied mathematics. After over 150 man-years of development effort, MACSYMA is being extended in new directions, to make it the core of an integrated mathematical computation system. The purpose of this minisymposium is to present the recent progress of MACSYMA toward this goal, and to discuss future directions and user needs.

Organizer: **Richard Petti**
Symbolics, Inc.

Focusing MACSYMA Development on User Needs
(To be presented by the Organizer)

Recent and Proposed Symbolic Mathematics Enhancements to MACYSMA
Jeffrey P. Golden
Symbolics, Inc.

Implementation of Perturbation Methods for ODEs in MACSYMA
Jonathan L. Len
Symbolics, Inc.

Interfacing MACYSMA With Other Languages
Dan Nguyen
Symbolics, Inc.

Friday, July 15/2:00 PM
Minisymposium 30/Nicollet D-2

NUMERICAL DEVICE AND PROCESS MODELING FOR VLSI SYSTEMS

The partial differential equations associated with process and device models arising from VLSI systems are quite difficult to solve. Moreover, the usual drift-diffusion model has recently received competition from more detailed alternatives such as the hydrodynamic mode. In this minisymposium, both the draft-diffusion and hydrodynamic models will be discussed and a variety of numerical algorithms ranging from new discretization methods to linear and nonlinear iterative methods for solving the discretized problem will be presented. Some open problems in simulating VLSI systems will be described.

Organizer: **William M. Coughran, Jr.**
AT&T Bell Laboratories

Hyperbolic Waves in the Hydrodynamic Model for Semiconductor Device Simulation
Carl L. Gardner
Duke University

Some Theoretical Aspects of the Discretization of the Semiconductor Equations
Thomas Kerkhoven
University of Illinois, Urbana

Some Computational Aspects of Short Device Simulation
F. Odeh and L, Reyna, IBM T. J. Watson Research Center

Numerical Aspects of Process and Device Modeling
R. K. Smith and R. Bank, AT&T Bell Laboratories

Friday, July 15/2:00 PM
Minisymposium 31/Nicollet C-1

ALGORITHMS FOR THE ALGEBRAIC EIGENVALUE PROBLEM ON PARALLEL ARCHITECTURES

The solution of very large matrix eigenvalue problems is recognized to be of major importance in many applications. The speakers will explore the behavior of algorithms for large eigenproblems in a multiprocessing environment. The focus will be on solutions which yield a complete set of eigenvalues and eigenvectors.

Development of various implementation of parallel algorithms is described, and the behavior and comparison of QR-based and Jacobi-like algorithms are presented. Experimental timings, costs, and speedups are given.

Special emphasis is given to the general problem and to the non-symmetric problem since they arise very often in applications such as control theory and signal processing.

Organizers: **Patricia J. Eberlein (Chair),** SUNY at Buffalo; and **Haesun Park,** University of Minnesota, Minneapolis

Finding Eigenvalues and Eigenvectors of Unsymmetric Matrices Using a Distributed-Memory Multiprocessor
G. A. Geist, Oak Ridge National Laboratory; and **G. J. Davis,** Georgia State University

Parallel Solution of the Eigenproblem on a Hypercube
Daniel Boley, and **Robert Maier,** University of Minnesota, Minneapolis

Jacobi-Like Algorithms for Non-Symmetric Eigenproblems on Hypercube
Patricia J. Eberlein, SUNY, Buffalo; and **Haesun Park,** University of Minnesota, Minneapolis

Friday, July 15/2:00 PM
Minisymposium 32/Nicollet D-3

THEORY AND COMPUTATION OF DEFECTS IN CONTINUOUS MEDIA

The formation of defect structures and the phase transitions experienced by many materials exemplify the large and dramatic changes in behavior whose control and prediction is assisted by nonlinear theory. Recent work has emphasized the development and implementation of computational methods in conjunction with theory. Sophisticated analyses of nonconvex, constrained, and three-dimensional problems have led to significant advances in the understanding of defect structures in liquid crystals, crystals, and other materials.

The speakers will attempt to give an assessment of developments expected in the near future.

Organizers: **David Kinderlehrer** (Chair), and **Mitchell Luskin,** University of Minnesota, Minneapolis

A Nonconvex Variational Problem Related to Change of Phase
Patricia Bauman, and Daniel Phillips, Purdue University, West Lafayette

Fractional Step Methods for Liquid Crystal Problem
Robert Cohen
University of Minnesota, Minneapolis

Relaxation Methods for Liquids Crystal Problems
San-Yih Lin
University of Minnesota, Minneapolis

Parametrized Measures: A Guide to Applications
Joao P. Matos
University of Minnesota, Minneapolis; and Lisbon Technical University

Friday, July 15/2:00 PM
Minisymposium 33/Nicollet D-1

(Title and speakers to be announced in final program)

CONTRIBUTED PRESENTATIONS

Monday, July 11/10:30 AM
Contributed Presentations 1/Greenway B

THEORY OF PARTIAL DIFFERENTIAL EQUATIONS

The Number of "Effective Modes" and the Collapsing Tendency of Solutions of the Spherically-Symmetric Nonlinear Shrödinger Equation
Bhimsen K. Shivamoggi and Ram N. Mohapatra, University of Central Florida

Mean Flow—Harmonic Interaction and Hydrodynamic Stability
Kwok Wing Chow, Washington State University

Galerkin Methods for a Singularly Perturbed Hyperbolic Problem with Nonlocal Nonlinearity
Benjamin F. Esham, Jr. and Elizabeth Greenwell Yanik, Virginia Commonwealth University

Numerical A Posteriori Proof for the Existence of Some Nonlinear Elliptic Partial Differential Equations
A. Bamberger, Institut Francais du Petrole and Maitre de Recherche a l'Ecole Polytechnique, France

Uniqueness of Recovery of a Discontinuous Conductivity Coefficient
Victor Isakov, Cornell University

Nonlinear Hyperbolic Conservation Systems in Extended Kinetic Theory
Vinicio C. Boffi, University of Bologna, Italy

Monday, July 11/10:30 AM
Contributed Presentations 2/Greenway A

FINITE ELEMENT TECHNIQUES

Exact Non-Reflecting Boundary Conditions
Joseph B. Keller and Dan Givoli, Stanford University

The Local Projection $p^0 p^1$ -Discontinuous-Galerkin Finite Element Method for Scalar Conservation Laws
Guy Chavent, INRIA and Universite Paris-Dauphine, France; and Bernardo Cockburn, University of Minnesota, Minneapolis

A Locally Refined Rectangular Grid Finite Element Method for Arbitrary Geometries. (Part I)
Robin G. Melvin and David P. Young, Boeing Computer Services; John E. Bussoletti and Forrester T. Johnson, Boeing Advanced Systems Company; and Satish S. Samant, Boeing Commercial Airplane Company, Seattle

A Locally Refined Rectangular Grid Finite Element Method for Arbitrary Geometries. (Part II)
David P. Young and Robin G. Melvin, Boeing Computer Services; John E. Bussoletti and Forrester T. Johnson, Boeing Advanced Systems Company; and Satish S. Samant, Boeing Commercial Airplane Company, Seattle

TVB Runge-Kutta Local Projection Discontinuous Galerkin Finite Element Method for Conservation Laws: One Dimensional Systems
Bernardo Cockburn and San-Yih Lin, University of Minnesota, Minneapolis; and Chi-Wang Shu, Brown University

Divergence Stability of the p-Version of the Finite Element Method for Stokes Equations
S. Jensen, University of Maryland, Baltimore; and M. Vogelius, University of Maryland, College Park

Monday, July 11/10:30 AM
Contributed Presentations 3/Nicollet D-1

OPTIMIZATION AND CONTROL

A New Utility Function Approach to Search Path Design
Edgar A. Cohen, Jr. and John W. Wingate, Naval Surface Warfare Center, Silver Spring

A Numerical Comparison of Optimization Softwares in IMSL, Harwell and NAG Libraries
D. Le, Australian Nuclear Science and Technology Organisation, Australia

Sequential Quadratic Programming in Function Spaces
C.T. Kelley and S.J. Wright, North Carolina State University, Raleigh

Towards The Optimal Rendez-Vou of Space Craft: An Application for Telecommunication Systems
M. El-Arabaty, Cairo, Egypt

New Investigations for Modern Pursuit-Evasion Games and Extended Applications
M. El-Arabaty, Cairo, Egypt

L1 Solution of Large-Scale Overdetermined Systems of Linear Equations
Robert H. Leary, G.A. Technologies, Inc., San Diego

Trust Region Algorithms using Inexact Function and Gradient Information
Richard G. Carter, ICASE-NASA Langley Research Center

A Quadratic Programming Implementation for Small Active Set Problems
Paul D. Frank and Michael Healy, Boeing Computer Services, Seattle

Controllability and Spectral Results for a Structurally Damped Euler-Bernoulli Beam
Scott W. Hansen, University of Wisconsin, Madison

Monday, July 11/3:30 PM
Contributed Presentations 4/Greenway C

ANALYSIS 1

A General Theory of Local Lyapunov Exponents
Alp Eden, Indiana University, Bloomington

Composite Functions and Their Taylor Series
Bruce Jeffrey Layman, Layman Engineering, West Richland

Nonatomic Neutral Functional Differential Equations as Semigroups on Product Spaces
Janos Turi, Worcester Polytechnic Institute

On Non-Linear Hodge Theory and Applications to Electro- and Magneto-Statics and Gas Dynamics
Rainer H. Picard, University of Wisconsin, Milwaukee

On Balance of Mass Flow with Applications to Simulated Annealing
Tzuu-Shuh Chiang and Yunshyong Chow, Academia Sinica, R.O.C.

Invariant Manifold Theorems For the Navier Stokes Equations
S.S. Sritharan, University of Southern California

Distributed Computational Methods
Avi Lin, Temple University

Some Existence Results for Flows of Viscoelastic Fluids with Differential Constitutive Equations
Colette Guilope and Jean-Claude Saut, Universite Paris-Sud and C.N.R.S., France

Monday, July 11/3:30 PM
Contributed Presentations 5/Greenway A

MATRICES AND LINEAR ALGEBRA

Displacement Ranks for Group Matrices
Paul D. Gader, University of Wisconsin, Oshkosh

On the Distinction Between Preconditioning and Reducing the Condition Number
Hillel Tal-Ezer, Brown University

Precision Control and Exception Handling
Thomas E. Hull, University of Toronto, Canada

VLSI Architecture for Toeplitz Principal Component Extractor
Muralidharan Swaminathan and Lokesh Datta, Wright State University, Dayton

Numerical Composition of Centrohermitian Matrices
Lokesh Datta, Wright State University, Dayton

Conditions for Optimality of Performance Indices Defined over the Matrix Spaces
Dan Ionescu, University of Ottawa, Canada

Monday, July 11/3:30 PM
Contributed Presentations 6/Greenway B

MATHEMATICS IN MEDICINE

Mathematical Implications of Two Multistage Models of Cancer Induction
Michael Gaffney, Pfizer, New York; and Bernard Altshuler, New York University Medical Center

Solution of a Model of the Mammalian Kidney Using Interactive Continuation: Role of Atrial Natriuretic Factor (ANF) on Urine Formation
Raymond Mejia and Mark A. Knepper, National Institutes of Health

A Mathematical Model of an Electromechanically Coupled Poroelastic Medium Driven by an Applied Electric Current
Jeffrey R. Sachs, University of Tokyo; and Alan J. Godzinsky, Massachusetts Institute of Technology

Modeling Thought Processes in a Brain by Klein-Gordon Equation
Syamala D. Vishnubhatla, Bell Communications Research, Inc., Piscataway, NJ

Stability Analysis of a Mathematical Model of the Respiratory Control System
Janos Turi and Frederick M. Bennett, Worcester Polytechnic Institute

A Kinetic Model of T-Lymphocyte Interactions with the Human Immune Deficiency (AIDS) Virus (HIV)
John E. Fletcher, Richard I. Shrager, James J. Bailey and William L. Jackson, National Institutes of Health

Flow of Red Blood Cells in Capillaries with Near Minimal Diameters
D. Halpern and T.W. Secomb, University of Arizona

Special Notice to Contributed Presentation Authors and Chairmen of Contributed Presentation Sessions:

Fifteen minutes are allowed for each contributed presentation. Presenters are requested to spend a maximum of 12 minutes for their presentation, and 3 minutes for questions and answers.

Please note:

For presentations with more than one author, an underlineation is used to denote the author who will present the paper.

CONTRIBUTED PRESENTATIONS

Tuesday, July 12/10:30 AM
Contributed Presentations 7/Greenway A

MATERIALS SCIENCE

Conservative Configuration Dependent Forces
Dawn Fisher, James Madison University

A Decoupled Approach for the Simulation of Visco-Elastic Fluid Flows
Andre Fortin, Ecole Polytechnique de Montreal, Canada; and Michel Fortin, Universite Laval, Canada

A Numerical Investigation of Oscillatory Motion in the Zone Refining of Liquid Si
Joseph S. Wilkowski, Manhattan College, Riverdale; and Nicholas D. Kazarinoff, SUNY, Buffalo

Modeling the Rayleigh-Taylor Response of Elastic-Plastic Solids
Allen C. Robinson, Sandia National Laboratories, Albuquerque

Exact Numerical Solution of the Reimann Problem for Solids
Charles H. Neil, Los Alamos National Laboratory

Reconstruction of Continuous Material Interfaces from Volume Fraction Data
Gary A. Dilts, Los Alamos National Laboratory

On Entropy Generation in Viscous Shear Flows
Joseph C. Klewicki and John J. McGrath, Michigan State University

Design and Retrofitting of Aluminum Reduction Cells by Numerical Modelling
Essam Eldin Khalil, Cairo University, Egypt

Tuesday, July 12/10:30 AM
Contributed Presentations 8/Nicollet D-1

SIGNAL PROCESSING AND DATA ANALYSIS

The Problem of Inverse Filtering
Farokh Marvasti and Liu Chuande, Illinois Institute of Technology

A Two Term Recursion to Generate a Sampled Sine Wave and Other Signal Processing Techniques
Budrow Swartzendruber, Department of Defense, Fort George G. Meade

A Recursive Filtering Algorithm for Stochastically Moving Measurement Nodes
C.N. Shen and Yaobin Chen, Rensselaer Polytechnic Institute

Radon Transform Over Finite Fields and Its Application to Signal Processing
Izidor Gertner, Technion - Israel Institute of Technology

Compressed Planetary and Lunar Ephemeris
Peter C. Kammeyer, U.S. Naval Observatory, Washington, DC

The Application of a Prolate Spheroidal Function Approximation to Multi-Resolution Pyramid Generation
Todd R. Reed, University of Minnesota, Minneapolis

Convexity for Box Splines
Thomas A. Grandine, Boeing Computer Services Company, Seattle

Tuesday, July 12/10:30 AM
Contributed Presentations 9/Greenway B

FREE SURFACE PROBLEMS

Free Streamline Flows Past Polygonal Obstacles with Double Spiral Vortices
Piero Bassanini, University de Roma, "La Sapienza", Italy; and Alan Elcrat, Wichita State University

Comparison of Techniques for Solution of a Free Surface Problem
John E. Molyneux and Fred G. Daddi, Widener University

Numerical Solution of Parabolic Free Boundary Value Problems
Fritz Keinert, University of Utah

Mechanics of Liquid-liquid Contact
H. Oguz and A. Prosperetti, Johns Hopkins University

Solution of a Stefan Problem by Reduction to a Parabolic Inverse Problem
Barbara Bakins and Igor Malyshev, San Jose State University

Analytical and Numerical Studies of Liquid Curtains
J.I. Ramos, Carnegie-Mellon University

On the Boundary Integral Formulation of Free Surface Problems
Gretar Tryggvason, University of Michigan, Ann Arbor

Tuesday, July 12/3:30 PM
Contributed Presentations 10/Greenway B

ANALYSIS 2

Certain Integrals of Products of Ultraspherical Functions
Mihr J. Shah, Kent State University, Warren

Following Envelopes of Symmetry-Breaking Bifurcation Points
John H. Bolstad, Lawrence Livermore National Laboratory

Minimal Representation of Singular System of Differential Equations
Pradeep Misra, Wright State University, Dayton

Solution of Boundary Value Problems by Multi-Dimensional Laplace Transformation Method
R.S. Dahiya, Iowa State University

On the Theory of N-Dimensional Laplace Transform and its Application to Boundary Value Problems
Joyati Debnath, University of Wisconsin, River Falls; and Rajbir S. Dahiya, Iowa State University

The Initial Value Problem for Fractional Order Differential Equations with Constant Coefficients
Ronald L. Bagley, Air Force Institute of Technology

The Computation of Centralizer of Subgroup in the Symmetric Semigroup and an Application
Guangfu Zhou, University of Arkansas, Fayetteville

Z Transforms in Pseudo Banach Algebras
C.R. Giardina, Mahwah, NJ

Tuesday, July 12/3:30 PM
Contributed Presentations 11/Greenway A

PARALLEL ALGORITHMS

On Parallelization of a Conjugate Gradient Minimization Method
D. Le, Australian Nuclear Science and Technology Organisation, Australia

Parallel Algorithms for Nonlinear Least-Squares Problems
Rodrigo Fontecilla, University of Maryland, College Park

A Parallel Algorithm for Computing the Bidiagonalization of a Rectangular Matrix
Bruce W. Suter, Peng Chai and Charles R. Katholi, University of Alabama, Birmingham

Use of the LR Algorithm to Tridiagonalize a General Matrix
David S. Watkins and Weiyi Wang, Washington State University

Parallel Implementation of a Block Skyline Solver
Jim Armstrong, CONVEX Computer Corporation, Richardson

A Parallel Algorithm for Computing the L-D-L^T Decomposition of a Symmetric Nonnegative Definite Matrix
Pillai Krishnakumar and Bruce W. Suter, University of Alabama, Birmingham

Wednesday, July 13/10:30 AM
Contributed Presentations 12/Greenway B

GENERAL SESSION

Relations and Computability
Lere Shakunle, Matran Software International, West Germany

Discrete Geometries
Fred B. Holt, Boeing Electronics Company, Seattle

Verification Vision as a Nonlinear Least Squares Problem
Robert R. Goldberg, Queens College of CUNY

The Measure of Complexity in Cellular Automata
Rui M. Dilao, CERN, Switzerland

Discipline Related Writing Requirement at Saint Mary's College
Donald E. Miller, Saint Mary's College, Notre Dame, IN

Wednesday, July 13/10:30 AM
Contributed Presentations 13/Greenway A

MATHEMATICS IN BIOLOGY

A Comparison of Dispersal Strategies for Survival of Spatially Heterogeneous Populations
Douglas P. Hardin, Peter Takac and Glenn F. Webb, Vanderbilt University, Nashville

Critical Patch Size for Discrete Reaction Diffusion Models
Linda J.S. Allen, Texas Tech University, Lubbock

Order Reduction of Higher Order Nonlinear Difference Equations
Weijiang Zhang, Northeastern University

A Numerical Method for the Estimation of Variable Time Delays with Applications to Biology
Katherine A. Murphy, University of North Carolina, Chapel Hill

Population Dynamics With Age Dependence and Diffusion: Localization
Gaston E. Hernandez, University of Iowa

Thursday, July 14/10:30 AM
Contributed Presentations 14/Greenway A

FLUID FLOW AND HEAT TRANSFER 1

Numerical Study of the Stability and the Transition of Pipe Flow, Using a Two-Point Boundary Value Method
Gerardo A. Ache, Universidad Central de Venezuela

A Probabilistic Model of the Apparent Radiance of a Rough Sea
Richard G. Priest and Ira B. Schwartz, Naval Research Laboratory, Washington, DC

A Fast Solver for Potential Flow in Channels
Leslie Greengard, Yale University

Numerical Solution to a Problem in the Flow of a Viscoelastic Fluid between Rotating Cylinders
Bruce A. Drew, Minneapolis; Doraiswami Ramkrishna, Purdue University; and Leon Levine, Leon Levine Associates, Plymouth, MN

Asymptotic Analysis of Volterra Integral Equations: Application to Heat Transfer
D. Glenn Lasseigne, Old Dominion University

The Effects of Compressibility on a Non-orthogonal, Stagnation-point Flow Impinging on a Hot or Cold Isothermal Plate
D. Glenn Lasseigne, Old Dominion University

CONTRIBUTED PRESENTATIONS

Thursday, July 14/10:30 AM
Contributed Presentations 15/Greenway B

REACTION-DIFFUSION AND HEAT CONDUCTION

Fast Reaction, Slow Diffusion, and Flow by Curvature
Jacob Rubinstein, Peter Sternberg and Joseph B. Keller, Stanford University

ECE Versus DISP Electrochemical Competition
Susan Cole and Joseph W. Wilder, Rensselaer Polytechnic Institute

Diffusional/Thermal Instability of a Solid Propellant Flame
Stephen B. Margolis, Sandia National Laboratories; and Forman A. Williams, Princeton University

Detonation Shock Dynamics: Shock-State Dependent Rates
John B. Bdzil, Los Alamos National Laboratory; and D. Scott Stewart, University of Illinois, Urbana

Homogenisation Results for Non Linear Heat Conduction Equation in Heterogeneous Media
Michael Artola, Centre d'Etudes Scientifiques at Techniques d'Aquitaine and Universite De Bordeaux 1, France

Inverted Bifurcation Model of Discrete Roll Transitions in Thermal Convection
J.R. Leith, University of New Mexico

Thursday, July 14/10:30 AM
Contributed Presentations 16/Nicollet D-1

WAVE PROPAGATION 1

Interfacial Waves Theory for Dendritic Structure of Needle Crystal
Jian-Jun Xu, USRA/NASA at Marshall Space Flight Center

Free Boundary Conditions of Arbitrary Polygonal Topography in a 2-D Explicit Elastic Finite-Difference Scheme
Ron-Song Jih, Teledyne Geotech Alexandria Laboratories, Alexandria, VA

Modulated Phase Shift for Strongly-Nonlinear, Slowly-Varying, Perturbed, Dispersive Waves
F. Jay Bourland and Richard Haberman, Southern Methodist University

Evolution Equations for Interfacial Waves in Liquid Crystals
H.C. Morris, Y.K. Kowk and L. Lam, San Jose State University

Time-Dependent Solutions to Nonmixed End Condition Problems in Elasticity
I.S. Goldberg, St Mary's University, San Antonio; and R.T. Folk, Lehigh University, Bethlehem, PA

Spectral Boundary Integral Method for Gravity-Capillary Waves
William W. Schultz and Jin Huh, University of Michigan, Ann Arbor

Thursday, July 14/3:30 PM
Contributed Presentations 17/Greenway A

NUMERICAL ANALYSIS (ALGEBRA)

Two Parallel Iterative Schemes
Jerard M. Barry, and John P. Pollard, Australian Nuclear Science and Technology Organisation, Australia; and Eugene L. Wachspress, University of Tennessee, Knoxville

Use of Dominated Functions to Find a Bounded Domain Containing all the Roots of a Nonlinear Function
Xingren Ying and I. Norman Katz, Washington University, St. Louis

Rapidly Convergent Hybrid Algorithms for Finding a Zero of a Function
Dalcidio Moraes Claudio, Universidade do Rio Grande do Sul, Brasil

On an Equidistand Collocation Method
Natalia Sternberg, Clark University

Solving Multiple Tridiagonal Systems on the Cyber 205
Ronald F. Boisvert, National Bureau of Standards, Gaithersburg

Thursday, July 14/3:30 PM
Contributed Presentations 18/Greenway B

DYNAMICAL SYSTEMS AND CHAOS

Subharmonic Control of the Birth and Death of Chaotic Attractors
Ira B. Schwartz, US Naval Research Laboratory, Washington, DC

Amplitude Modulated Chaos in Harmonically Excited Mechanical Systems
Anil K. Bajaj and Joseph M. Johnson, Purdue University, West Lafayette

Numerical Computation and Continuation of Invariant Manifolds Connecting Fixed Points
Eusebius J. Doedel, California Institute of Technology; and Concordia University, Canada; and Sat Nam S. Khalsa, University of Alabama, Huntsville

One-Degree of Freedom Motion Induced by Modeled Vortex Shedding
Leslie A. Yates, NASA Ames Research Center; Aynur Unal, US Army Aviation Research and Technology Acitivty; Michael Szady and Gary T. Chapman, NASA Ames Research Center

Diffusion Induced Bifurcation of Traveling Waves From Standing Waves in an Excitable Media
Jack D. Dockery, Utah State University

Irreducible Forms, Invariants and Stability for a System Describing Second Harmonic and/or Subharmonic Generation in a Medium with Quadratic and Cubic Nonlinearities
Partha P. Banerjee, Syracuse University; Frank Verheest, State University of Ghent, Belgium; and Willy Hereman, University of Wisconsin, Madison

Painleve Analysis, Integrability and Particular Solutions to Fifth Order Dispersive Evolution Equations
Willy Hereman, University of Wisconsin, Madison; Partha P. Banerjee, Syracuse University; and Frank Verheest, State University of Ghent, Belgium

Instabilities, Nonlinear Modes, and Low-Dimensional Chaos in the Dynamics of a Forced Elastic Rod: Experiments and Theory
J.P. Cusumano and F.C. Moon, Cornell University

Thursday, July 14/3:30 PM
Contributed Presentations 19/Greenway C

MECHANICS, OPTICS, ELECTROMAGNETISM

Unilateral Contact Between a Square Plate and an Elastic Layer
J.P. Dempsey and H. Li, Clarkson University

Losses for Vector Solutions of Infrared Whispering-Gallery Waveguides
W. Kath, J. Jiao, X. Fang and M. Marhic, Northwestern University

Losses for Full Vector-Mode Solutions of Arbitrarily Bent Optical Fibers
Ann Kahlow Hobbs and William L. Kath, Northwestern University

Resonant Forcing of a Damped Simple Pendulum
Peter J. Bryant, University of Canterbury, New Zealand

Application of Control Region Approximation To Guided Wave Computation
Brian J. McCartin, United Technologies Research Center, East Hartford

Least Noise Trim Patterns for Laser Trimmed Resistors
Deborah Penick Levinson and Arthur David Snider, University of South Florida, Tampa

Bifurcations and Periodic Solutions of the Kinetic Equations for Collisionless Plasmas
James Paul Holloway and J.J. Dorning, University of Virginia

Fast Interactive Ising Codes on the AMT DAP 510
Stewart F. Reddaway, Active Memory Technology Ltd., England

Friday, July 15/10:30 AM
Contributed Presentations 20/Greenway B

DOMAIN DECOMPOSITION AND GRID METHODS

Spectral Domain Decomposition Techniques for Solving Poisson and Biharmonic Problems Possessing Reentrant Corner Singularities
T.N. Phillips, University College of Wales, United Kingdom

New Technique for Finite Element Mesh Generation by Using Coon's and Bezier Interpolation
Norihiro Nakajima, Hitachi Ltd., Japan

Cell-Dynamical System Modeling of Nonequilibrium Phenomena
Y. Ono, C. Yeung and M. Bahiana, University of Illinois, Urbana

Effects of Grid Irregularity on Iterative Methods
George J. Fix and Tsu-Fen Chen, University of Texas, Arlington

Optimal Triangulation Incidence for Interpolating Convex Quadratic Surfaces
Eduardo D'Azevedo, University of Waterloo, Canada

Automatic Mesh Generation Based on a Vertex Label Assignment Scheme
Fuhua Cheng and Jerzy W. Jaromczyk, University of Kentucky; Junnin-Ren Lin, National Tsing Hua University, China; Shyue-Shian Chang and Jei-Yeou Lu, Chung-Shang Institute of Science and Technology, China

Grid Refinement in Nonlinear SOR
Tsu-Fen Chen and R. Kannan, University of Texas, Arlington

The Fast Adaptive Composite Grid Method for Time-dependent Problems
J.W. Thomas and M. Heroux, Colorado State University

CONTRIBUTED PRESENTATIONS

Friday, July 15/10:30 AM
Contributed Presentations 21/Greenway A

APPLIED GEOMETRY AND FRACTALS

Is Henon's Strange Attractor Really Strange?
Gregory J. Davis, University of Wisconsin, Green Bay

Strange Saddles and the Dimensions of Their Invariant Manifolds
Guang-Hsong Hsu, Naval Surface Weapon Center, Silver Spring; Edward Ott and Celso Grebogi, University of Maryland, College Park

On the Dimension of Fractal Functions which are Attractors of Dynamic Systems
Peter R. Massopust, LaGrange College

Symmetry and Periodicity of Generalized Mandelbrot Sets
J.R. Caspar, J.C. Hanson and R.E. LaBarre, United Technologies Research Center, East Hartford

Error Estimates for the Calculation of Fractal Dimension
Fern Hunt, Howard University, Washington, DC

Layered Representation of 3-D Surface Using Level Curves and Its Orthogonal Curves
Ha-Jine Kimn, Ajou University, South Korea

Fast Evaluation of the Fractal Dimension of Boolean Images
Stewart F. Reddaway, Active Memory Technology Ltd., England

Constructive Deformations of Star Worlds for Exact Robot Navigation
Elon Rimon and Daniel E. Koditschek, Yale University

Friday, July 15/10:30 AM
Contributed Presentations 22/Greenway C

ORDINARY DIFFERENTIAL EQUATIONS

Construction and Investigation of Finite-Difference Models of the Van der Pol Equation Using A Discrete Multi-Time Procedure
Ronald E. Mickens, Atlanta University

On the Numerical Reconstruction of Forcing Terms
Diego A. Murio and Doris Hinestroza, University of Cincinnati

A Stability Criterion for Boundary Values Runge-Kutta Methods
Aron Jazcilevich and Reginald P. Tewarson, SUNY, Stony Brook

Efficient Numerical Solution of Time-Varying Stiff Riccati Differential Equations
Chiu Choi and Alan J. Laub, University of California, Santa Barbara

Consistent Initialization of Differential-Algebraic Equations
Benedict J. Leimkuhler and C.W. Gear, University of Illinois, Urbana; and Linda R. Petzold, Lawrence Livermore National Laboratory

Two-Step Obrechkoff Methods for Periodic Initial Value Problems
David A. Voss, Western Illinois University; and A.Q.M. Khaliq, Bahrain University

Friday, July 15/2:00 PM
Contributed Presentations 23/Greenway A

NUMERICAL ANALYSIS (PDEs)

Total Variation Stable Time Discretizations for Non-oscillatory Schemes
Chi-Wang Shu, Brown University

Transfer Function Matrices of Degenerate Differential Systems
Pradeep Misra, Wright State University, Dayton

Filtration in Partially Saturated Layered Porous Media
Xiao Shutie and Huang Zhida, Tsinghua University, China

Numerical Solutions for Forced Nonlinear Oscillations of Beams
W. Mark Countryman, Louisiana Tech University; and R. Kannan, University of Texas, Arlington

Sinc-Collocation for Weakly Singular Volterra Equations
Bruce V. Riley, University of Wisconsin, La Crosse

k-Schemes for Evolutionary PDEs
Gholam-Ali Zakeri, University of Wisconsin, La Crosse

Integral Equations on the HP-28S
William Margulies, California State University, Long Beach

Friday, July 15/2:00 PM
Contributed Presentations 24/Greenway C

FLUID FLOW AND HEAT TRANSFER 2

Nonlinear Dynamics in Two-Phase Flow with Three Forcing Functions
Rizwan-uddin and J.J. Dorning, University of Virginia

Computational Methods for Solving Variational Problems in Fluid Dynamics
Alexander Eydeland, University of Massachusetts, Amherst

Stability of Drawn Fibers
Charles Thompson and Monica Brown, University of Lowell

Acoustic Wave Interactions a Mean-Flow Stagnation Point
C. Thompson and M. Manley, University of Lowell

Surface Temperature Histories of Materials in the Presence of Surface Reradiation
M.A. Delichatsios and J. de Ris, Factory Mutual Research Corporation, Norwood, MA

Friday, July 15/2:00 PM
Contributed Presentations 25/Greenway B

WAVE PROPAGATION 2

Selection Mechanisms and Resonant Limits in the Perturbed Nonlinear Schrödinger Equation
Paul Newton, University of Illinois, Urbana

Internal Solitary Waves of Large Amplitude
Stephen A. Pennel and Rida M. Mirie, University of Lowell

Wall Shear Effects on Solitary Wave Profiles in Thin Liquid Films
L. Michael Santi, Memphis State University

Sound Waves in Fogs
R. Duraiswami and A. Prosperetti, Johns Hopkins University

Acoustic Scattering from a Baffled Cavity-Backed Membrane Surrounded by an Elastic Layer
Gregory A. Kriegsmann, Edward L. Reiss and Vianey Villamizar, Northwestern University

Numerical Experiments for a Complex-Valued Nonlinear Klein-Gordon Equation
Jon C. Luke, Indiana University/Purdue University, Indianapolis

Robust Soliton-Like Properties
Ralph Kelsey, Bradley University

Surfing on Solitary Waves
J.-M. Vanden-Broeck, University of Wisconsin, Madison

POSTER PRESENTATIONS

Tuesday, July 12/3:30 PM
Poster Session 1/Exhibit Hall

The Accuracy of Numerical Conformal Mapping Methods
Thomas K. DeLillo, Duke University

The New Fortran Language
Alan Wilson, Active Memory Technology, Irvine

Fractal Regions in Hopf Bifurcations
Allan Moose, Long Island University, Southampton

Fixed Points of Higher Dimensional Dynamic Systems
Stephen T. Welstead and Thomas Cromer, COLSA, Inc., Huntsville

Singularly Perturbed Systems Containing Singular Manifolds
Zhong-Mei Gu, Rensselaer Polytechnic Institute

Fully Discrete Approximations of Parabolic Problems with Nonsmooth Dirichlet Boundary Data
Gilbert K. Choudury, University of Cincinnati

Probing Complex Iteration Functions Graphically
J.R. Caspar, J.C. Hanson and R.E. LaBarre, United Technologies Research Center, East Hartford

Regeneration of Images From IFS Codes on an Array Processor
S.F. Reddaway, Active Memory Technology Ltd., England

Wednesday, July 13/10:30 AM
Poster Session 2/Exhibit Hall

Supercomputer Dynamic Simulation of Sustained Chemical Oscillations
Robert F. Stetson, Florida Atlantic University; William A. Hogan, Convex Computer Corporation, Richardson

Numerical Simulation of Precipitate Nucleation and Growth
J.P. Lavine and G.A. Hawkins, Eastman Kodak Company, Rochester

Snells Laws at the Interface Between Nonlinear Dielectrics
Alejandro Aceves, Jerome V. Maloney and Alan C. Newell, University of Arizona

Application of Singular Perturbation in Modeling Load Disturbances For Power Systems Reliability Evaluation
J. Qiu, Clemson University; and S.M. Shahidehpour, Illinois Institute of Technology

On the Thermomechanical Characterization of Thin Film Superconductors
Georges V. Abi-Ghanem, EWA, Inc., Minneapolis

A Salary Structure Simulation Model
Donald E. Miller, St Mary's College, Notre Dame, IN

On Built-in Balanced Models with Guaranteed Structural Parameters
L. Fortuna, A. Gallo, G. Nunnari and P. Zuccarini, Universita di Catania, Italy

The Consistency of an Asymptotic Method with the Result of Inverse Scattering Method for a Model Equation of Water Waves
Qisu Zou, Kansas State University

Integral Equation Solution of Viscous Free Surface Flow Problems
Erik B. Hansen, Technical University of Denmark

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MULTIGRID METHODS

Edited by Stephen F. McCormick

Frontiers in Applied Mathematics 3

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A thoughtful consideration of the current level of development of multigrid methods, this volume is a carefully edited collection of papers that addresses its topic on several levels. The first three chapters orient the reader who is familiar with standard numerical techniques to multigrid methods, first by discussing multigrid in the context of standard techniques, second by detailing the mechanics of using the method, and third by applying the basic method to some current problems in fluid dynamics. The fourth chapter provides a unified development, complete with theory, of algebraic multigrid (AMG), which is a linear equation solver based on multigrid principles. The last chapter is an ambitious development of a very general theory of multigrid methods or variationally posed problems. Included as an appendix is the latest edition of the Multigrid Bibliography, an attempted compilation of all existing research publications on multigrid.

Contents. Preface; Introduction, *W. Briggs and S. McCormick;* Linear Multigrid Methods, *P. Wesseling;* Multigrid Approaches to the Euler Equations, *P. W. Hemker and G. M. Johnson;* Algebraic Multigrid, *J. W. Ruge and K. Stuben;* Variational Multigrid Theory, *J. Mandel, S. McCormick, and R. Bank;* Appendix 1, MV Program Listing; Appendix 2, Multigrid Bibliography, KWIC Reference Guide; Index.

Published December 1987

A MULTIGRID TUTORIAL

William L. Briggs

ix + 88 pages, Softcover
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Assuming little familiarity with basic iterative methods and no acquaintance with multigrid, this tutorial begins from first principles. First, conventional relaxation methods applied to systems of linear equations are analyzed, since an understanding of their convergence properties and limitations is essential to multigrid. Second, the fundamental two-grid cycling scheme is discussed, leading to the introduction of the necessary intergrid transfer functions. The standard multigrid schemes are then presented. This tutorial concludes with an explanation of "why multigrid works."

Published September 1987

LINEAR ALGEBRA IN SIGNALS, SYSTEMS, AND CONTROL

Edited by B. N. Datta, C.R. Johnson, M.A. Kaashoek, R. Plemmons, and E. Sontag

67 pages (est.), Hardcover
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Proceedings of the SIAM Conference on Linear Algebra in Signals, Systems, and Control held in Boston, May 1986. Forty-six papers by mathematicians, computer scientists, and engineers present results on analytic and computational linear algebra and its applications to mathematical systems theory; geometric theory of multivariable control; signal processing; estimation, filtering, and prediction; and robust, adaptive, and stochastic control. Divided evenly among the general areas of systems and control theory, algorithms for signal processing and control, numerical linear algebra, and linear algebra, this collection will be of interest to all researchers involved in applying linear algebra and numerical methods to problems in signals and control.

Contents. Part I. Core Linear Algebra. Network Matrix Operations for Vectors and Quaternions, *W. N. Anderson and G. E. Trapp;* Inertia Theorems for Lyapunov and Riccati Equations—An Updated View, *Sergio Bittanti, Paolo Bolzern, and Patrizio Colaneri;* An Analogue of the Schur Triangular Factorization for Complex Orthogonal Similarity and Consimilarity, *Dipa Choudhury and Roger A. Horn;* Mixed Multiplicativity for 1p Norms of Matrices, *Moshe Goldberg;* The Structure of Root Clustering Criteria, *Shaul Gutman;* Extended Inertia Theorems for Discrete-Time Periodic Lyapunov and Riccati Equations, *Vicente Hernández and Ana Urbano;* On the Discrete Relationship Between Matrix Continued Fractions and the Maximal (A,B)-Invariant Subspace in KerC, *Tzila Shamir;* Determinantal Representations of Algebraic Curves, *Victor Vinnikov;* Eigenvalues of Centrosymmetric Matrices, *James R. Weaver.* **Part II. Numerical Linear Algebra.** Superfast Solution of Real Positive Definite Toeplitz Systems, *Gregory S. Ammar and William B. Gragg;* Accurate Solutions of Ill-Posed Problems in Control Theory, *James Demmel and Bo Kagström;* A Product Induced Singular Value Decomposition (πSVD) for Two Matrices and Balanced Realization, *K. Vince Fernando and Sven Hammarling;* An Algorithm for Subspace Computation, with Applications in Signal Processing, *Daniel R. Fuhrmann;* On Minimizing the Maximum Eigenvalue of a Symmetric Matrix, *Michael L. Overton;* A Two-Level Preconditioned Conjugate Gradient Scheme, *D. J. Pierce and R. J. Plemmons;* Hyperbolic Householder Transforms, *Charles M. Rader and Allan O. Steinhardt;* Total Least Squares Approach for Solving the Linear Prediction Equation, *M. A. Rahman and Kai-Bor Yu;* Iterative Methods in the Solution of Dependability Models, *J. A. Sjogren;* Numerical Solution of the Eigenvalue Problem for Symmetric Rationally Generated Toeplitz Matrices, *W. F. Trench;* Preconditioned Conjugate Gradient Algorithms and Software for Solving Large Sparse Linear Systems, *David M. Young, Kang C. Jea, and Tsun-Zee Mai.* **Part III. Algorithms for Signals, Systems, and Control.** Controller Parameterization and Recursive Design Using Implicity Systems, *J. D. Aplevich and K. Morris;* A Pencil Approach for Embedding a Polynomial Matrix into a Unimodular Matrix, *T. Beelen and P. Van Dooren;* Two Techniques for the Solution of the Discrete-Time Periodic Riccati Equation, *Sergio Bittanti, Patrizio Colaneri, and Giuseppe De Nicolao;* Parallel Processing in the Adaptive Control of Linear Systems, *Roberto Cristi;* Applications of the Quotient-Difference Algorithm to Modern Spectral Estimation, *J. R. Cruz and Zoran Banjanin;* Sensitivity Analysis of Digital Filter Structures, *Victor E. DeBrunner and A. A. (Louis) Beex;* Algorithms for Interpolation with Outer Functions, *C. Ganesh;* Integrating Different Symbolic and Numeric Tools for Linear Algebra and Linear Systems Analysis, *Ulf Holmberg, Mats Lilja, and Bengt Mårtensson;* A Sympletic Orthogonal Method for Single Input or Single Output Discrete Time Optimal Control Problems, *Volker Mehrmann;* A Determinant Identity and Its Applications in Evaluating Frequency Response Matrices, *P. Misra and R. V. Patel;* Square Root V-Lambda Filtering Using Normalized State Estimates, *Yaakov Oshman and Itzhack Y. Bar-Itzhack;* A Minimal Partial Realization Algorithm for Data with Relative Errors, *Marc Van Barel and Adhemar Bultheel.* **Part IV. Linear and Nonlinear Control and Systems Theory.** A Geometric Approach to Errors-In-Variables Models, *Anthony M. Bloch;* Bilinear Nonlinear Descriptor Control Systems, *Stephen L. Campbell;* Noninteracting Decomposition of Linear Systems, *Daizhan Cheng;* Balanced Realization via Permutation Symmetric Jordan Realizations, *Jose A. De Abreu-Garcia and Frederick W. Fairman;* Algebraic Conditions for Absolute Tracking Control of Continuous-Time Lurie Systems, *Ljubomir T. Grujic;* Necessary and Sufficient Conditions for Subspace Reachability and Controllability of Discrete-Time, Time-Invariant Linear Dynamical Systems, *Fumio Hamano;* Reachability of Linear Systems with Subspace Open Constraints, *Jia-Yuan Han and Bostwick F. Wyman;* Robust Stability and Stabilization in Parameter Space, *L. H. Keel and S. P. Bhattacharyya;* A Comparative Study of Two Minimum Variance Regulators for Linear Stochastic Systems, *A. K. Mahalanabis and Premal Desai;* Dynamic High-Gain Stabilization of Multivariate Linear Systems, with Application to Adaptive Control, *Bengt Mårtensson;* Frequency Estimates for Simple Oscillating Systems Under Random Forcing, *L. I. Perlovsky;* Fault Detection Using a Linear Algebraic Approach, *Asok Ray and Mukund Desai;* A Unifying Framework for the Design and Implementation of Robot Controllers, *Vassilios D. Tourassis;* A State Space Approach to the Design of Orthogonal Models, *Srbijanka R. Turajlić and Sydney R. Parker.*

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Edited by Roland Glowinski, Gene H. Golub, Gerard A. Meurant, and Jacques Periaux

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Proceedings of the First International Symposium on Domain Decomposition Methods for Partial Differential Equations held at Ecole Nationale des Ponts et Chaussées in Paris on January 7–9, 1987. Topics discussed include theoretical foundations of the methods and the underlying approximation theory, applications to the solution of complex problems in structural and fluid dynamics, and implementation on vector and parallel computers. Discussions of block relaxation and element by element methods and other related techniques are also included.

Contents. On the Schwarz Alternating Method. I, *P. L. Lions;* A Method of Domain Decomposition for Three-Dimensional Finite Element Elliptic Problems, *M. Dryja;* Domain Decomposition Preconditioners for Elliptic Problems in Two and Three Dimensions: First Approach, *Joseph E. Pasciak;* Poincaré-Steklov's Operators and Domain Decomposition Methods in Finite Dimensional Spaces, *V. I. Agoshkov;* Iterative Substructuring Methods: Algorithms and Theory for Elliptic Problems in the Plane, *Olof B. Widlund;* An Iterative Procedure for Domain Decomposition Methods: A Finite Element Approach, *L. D. Marini and A. Quarteroni;* Domain Decomposition and Mixed Finite Element Methods for Elliptic Problems, *Roland Glowinski and Mary Fanett Wheeler;* Spectral Element Methods: Algorithms and Architectures, *Paul Fischer, Einar M. Rønquist, Daniel Dewey, and Anthony T. Patera;* Mixing Finite Elements and Finite Differences in a Subdomain Method, *M. Boulbrachene, Ph. Cortey-Dumont, and J. C. Miellou;* A Framework for the Analysis and Construction of Domain Decomposition Preconditioners, *Tony F. Chan and Diana C. Resasco;* Domain Decomposition Versus Block Preconditioning, *Gérard Meurant;* Comparison of Lanczos with Conjugate Gradient Using Element Preconditioning, *B. Nour-Omid, B. N. Parlett, and A Raefsky;* Fully Vectorized EBE Preconditioners for Nonlinear Solid Mechanics: Applications to Large-Scale Three-Dimensional Continuum, Shell and Contact/Impact Problems, *Thomas J. R. Hughes and Robert M. Ferencz;* Element-By-Element and Implicit-Explicit Finite Element Formulations for Computational Fluid Dynamics, *T. E. Tezduyar and J. Liou;* Iterative Methods for Substructured Elasticity Problems in Structural Analysis, *Petter E. Bjørstad and Anders Hvidsten;* On Some Difficulties Occurring in the Simulation of Incompressible Fluid Flows by Domain Decomposition Methods, *J. Cahouet;* Schwarz's Decomposition Method for Incompressible Flow Problems, *M. Fortin and R. Aboulaich;* On the Coupling of Viscous and Inviscid Models for Incompressible Fluid Flows Via Domain Decomposition, *Q. V. Dinh, R. Glowinski, J. Périaux, and G. Terrasson;* Vortex Subdomains, *Karl Gustafson and Robert Leben;* Simulation of Transonic Viscous Wing and Wing-Fuselage Flows Using Zonal Methods, *Jolen Flores;* Block-Structured Solution of Transonic Flows, *A. Ecer;* Domain Decomposition for the Simulation of Transient Problems in CFD, *R. Löhner and K. Morgan.*

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Proceedings of the Second Engineering Foundation Conference on Qualitative Methods for the Analysis of Nonlinear Dynamics held at New England College in June 1986, which brought together researchers from applied mathematics and engineering to focus on sample works and approaches of dynamical systems that are useful in treating nonlinear circuits and systems in engineering and in physical sciences. Developments addressed include the increased use of computer algebra in normal form and bifurcation calculations, the introduction of algebraic ideas to the study of bifurcations of systems with symmetries, the interaction between noise and deterministic chaos, use of the methods of bifurcation theory in control, methods of reduction in the dynamics of coupled rigid bodies, and bifurcations of the equilibria of the rotations double-jointed pendulum.

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Published January 1988

CONTACT PROBLEMS IN ELASTICITY: A STUDY OF VARIATIONAL INEQUALITIES AND FINITE ELEMENT METHODS

N. Kikuchi and J.T. Oden

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☐ If you are not enclosing payment and your order totals less than $30, add an invoicing charge of $3.

Indicate your selection:

Quantity	Order Code	Title	Price	Total

Subtotal _____

Handling charges _____

Optional priority shipping charge _____

TOTAL _____

TRANSPORTATION INFORMATION

BY AIR

UNITED and **DELTA AIRLINES** have been chosen as the official carriers for this meeting. You can fly to Minneapolis and save on travel from July 8, 1988 thru July 18, 1988 inclusive.

In a special arrangement with SIAM, United and Delta Airlines are offering you the services of their toll free convention reservation desks, along with a complement of discounts:

- 5% off any fare for which you qualify, including First Class and Ultra Saver Fares.
  THE DISCOUNTS CAN RANGE FROM 40%–70% OFF NORMAL COACH FARES!

OR . . . *for those of you who do not qualify for the above discounts*

- United and Delta Airlines will offer a minimum of 40% off regular coach fares. There is no minimum stay or advance purchase required with United Airlines, or Delta Air Lines.
- United and Delta Airlines have a special discounted fare that we at SIAM encourage you to ask for. It does involve staying overnight either the Saturday before or after the conference. However, in many cases the cost of the hotel for the extra night is still cheaper than paying the airfare to arrive on a Sunday and depart on a Thursday or Friday.

To make reservations for one of the above discounted fares:

- Call United Airlines Convention Desk, at 1-800-521-4041, seven days a week 8:00 AM to 11:00 PM Eastern Time. Be sure to mention the SIAM account number: 8129D
- Call Delta Air Lines Convention Desk, at 1-800-241-6760, seven days a week 8:00 AM—8:00 PM Eastern Time. Be sure to mention the SIAM account number: UO315.
- Both United and Delta Airlines will arrange to mail your tickets to your home or office, or you may purchase them from your local travel agent. If you purchase from your local travel agent, be sure you or the agent call United or Delta's Convention Desk to make your reservations. The special SIAM fare is only available through the Convention Desks.

CAR RENTAL

DOLLAR RENT A CAR has been selected as the official car rental agency for the 1988 SIAM Annual Meeting. The following rates will apply:

Type of Car	Daily Rate	Weekly Rate
Economy	$31.00	$145.00
Compact	$33.00	$155.00
Intermediate	$34.00	$160.00
Standard	$36.00	$165.00
Premium	$39.00	$265.00

- We encourage you to make an advance reservation, as on-site availability cannot be guaranteed. Make reservations by calling: 1-800-421-6878. When making your reservation, be sure to give the SIAM account number CCMSP. You should also mention that you are attending the 1988 SIAM Annual Meeting, July 11–15, 1988, in Minneapolis, in order to receive the discounted rate.
- Cars may be picked up at the airport at the Dollar Car Rental Desk located in the baggage claim area of the airport.
- Cars must be picked up and dropped off at the same location.
- You must be 21 years of age and have a valid U.S. or International Driver's License. There is a $3.00 per day surcharge for drivers under 25 years of age.
- You will be given 150 free miles per day (cumulative) and charged $0.15 per mile thereafter.
- You must have one of the following credit cards to rent a car: AMEX, Master Card, VISA, Diners Club.
- The prices quoted do not include refueling services, tax, optional collision damage waiver, and personal accident insurance.

BY CAR

From the Airport

When leaving the airport stay to the right, take 494 North to 35 West. Follow 35 West for about 7 or 8 miles. This will take you directly into downtown Minneapolis. Exit on Eleventh Street. Stay in the left lane and go 3 lights until you intersect with Second Avenue. Make a left on Second Avenue and follow it until you reach 13th or Grant Street. Make a right on Grant or 13th Street and the Hyatt Regency is on the right approximately 1½ blocks down.

PUBLIC TRANSPORTATION FROM THE AIRPORT

The airport is approximately 20–25 minutes from the hotel. There is an airport shuttle called the Airport Limousine. You will find it coming every hour on the half hour outside the baggage claim area 5:30 AM–11:00 PM, seven days a week. The cost for a one way ticket is $6.50. However, if you purchase a round trip ticket for your return back to the airport at the time that you arrive, the entire round trip ticket is $9.50.

There are a number of different cab companies that rotate around the airport. The average one way cost from the airport to the hotel is $18.25.

HOTEL INFORMATION

Hyatt Regency Hotel
1300 Nicollet Mall
Minneapolis, MN 55403
(612) 370-1234

SIAM is holding a block of rooms at the Hyatt Regency Hotel. These rooms are being held on a first come, first served basis at $69/Single and $83/Double. ***These rooms will be held for our exclusive use only until June 24, after which date reservations will depend on availability.***

We urge you to make your reservations as soon as possible. You may do so by telephoning (612) 370-1234 or by mailing in the Hotel Reservation Form, located in the back of this program. *When making your reservation via phone, please be certain to identify yourself as an attendee at the 1988 SIAM Annual Meeting to receive the discounted rate.*

Late Arrival Policy: If you plan to check-in after 6:00 PM, you must guarantee your room for late arrival by making payment in advance for one night. Payment can be made by either AMEX, MC, VISA, DC or check.

Check-In: Check-in time is 3:00 PM and Check-out time is 12:00 PM. If you need to change or cancel your reservation, be certain to contact the hotel by 1:00 PM Eastern Time on your stated date of arrival to avoid any unnecessary charges.

Weather: It is said that the best possible time to be in Minneapolis is in July. Usually, the daily temperatures range from 75° to 90°. It is sunny yet not humid. Cool summer clothing is highly suggested.

About the Hotel: The Hyatt Regency is a downtown property, so you will find many areas highly accessible from the hotel. You can easily catch a cab outside the hotel and the average price for going anywhere within the downtown area is $2.00 per person with approximately $.50 per additional person. The Hyatt has 4 restaurants on premise, the Dynasty, which serves chinese cuisine; the Pronto, which serves Italian cuisine; the Willows, which is the Hyatt's formal dining restaurant; and the Terrace, which is more like a cafe serving light dishes and sandwiches. There is also 24 hour room service available in the hotel. The second floor of the hotel features a retail mart, a shopper's paradise with more than twenty individual boutiques and services ranging from gifts and apparel to florist and a bank. The Greenway Athletic Club is a year-round facility connected to the Hyatt with complete recreational facilities, featuring racquetball, squash, tennis, nautilus equipment, massages, running tracks, saunas, jacuzzi, hot tubs and a pro shop. This is available to the Hyatt Hotel guests at a rate of $6.00 per person. There is an indoor pool at the Hyatt that guests can utilize at no cost.

Parking: There is a large parking ramp attached to the Hyatt. Parking fee for hotel guests is $4.50 per day. For those not staying at the hotel, the cost for parking can range between $6.00 and $8.00 per day.

REGISTRATION INFORMATION

Please complete the Advance Registration Form found on the back page of this brochure and return it in the envelope provided in the middle section of this program. We urge attendees to register in advance, as the registration fee is lower for advance registrants. The registration desk will be open as listed below.

Saturday, July 9	5:00 PM–9:00 PM
Sunday, July 10	8:00 AM–9:00 PM
Monday, July 11	7:30 AM–5:30 PM
Tuesday, July 12	8:00 AM–6:00 PM
Wednesday, July 13	8:30 AM–4:30 PM
Thursday, July 14	8:00 AM–6:00 PM
Friday, July 15	8:00 AM–4:00 PM

SPECIAL EVENTS

Welcoming Reception
Sunday, July 10, 8:00 PM– 10:00 PM
Nicollet D1-D2
Cash Bar

Beer Party
Monday, July 11, 6:00 PM–8:00 PM
Exhibit Hall
$15.00

Wednesday, July 13, 6:30 PM–9:30 PM
Dinner/Mississippi River Boat Cruise
Boom Island, Minneapolis, MN
$28.00

REGISTRATION FEES:

		SIAM Member	Non Member	Student
Short Course	Advance	$ 95	$115	$55
	On-Site	$115	$135	$75
Meeting	Advance	$ 90	$110	$15
	On-Site	$110	$130	$15

Non SIAM Members
Non-member registrants are encouraged to join SIAM in order to obtain the member rate for meeting registration and enjoy all the other benefits of SIAM membership. You can join SIAM by filling out a membership form at the SIAM Registration Desk located in the Promenade of the Hyatt Regency Hotel. If you join for this conference, SIAM will retroactively give you the member rate for registration.

Special Note
There will be no prorated fees. No refunds will be issued once the meeting has started.

If SIAM does not receive your Advance Registration Form by the stated deadline, you will be asked to give us a check or a credit card number at the conference. We will not process either until we have ascertained that your registration form has gone astray. In the event that we receive your form after the conference, we will destroy your check or credit card slip.

Telephone Messages
The telephone number at the Hyatt Regency Hotel is 1-612-370-1234. The Hyatt Regency will either connect you with the SIAM registration desk or forward a message.

Credit Cards
SIAM is now accepting Visa, MasterCard and American Express for the payment of registration fees and special functions. When you complete the Advance Registration Form, please be certain to indicate the type of credit card, the number and the expiration date.

SIAM CORPORATE MEMBERS
Non-member attendees who are employed by the following institutions are entitled to the SIAM member rate.

Aerospace Corporation
Amoco Production Company
AT&T Bell Laboratories
Bell Communications Research
Boeing Company
Cray Research, Inc.
Culler Scientific Systems Corporation
E.I. DuPont de Nemours and Company
Eastman Kodak Company
Exxon Research and Engineering Company
General Electric Company
General Motors Corporation
Giers Schlumberger
GTE Laboratories, Inc.
Hollandse Signaalapparaten B.V.
IBM Corporation
Institute for Computer Applications in Science and Engineering (ICASE)
IMSL, Inc.
MacNeal-Schwendler Corporation
Marathon Oil Company
Martin Marietta Energy Systems
Mathematical Sciences Research Institute
Standard Oil Company of Ohio (SOHIO)
Supercomputing Research Center, a division of Institute for Defense Analyses
Texaco, Inc.
United Technologies Corporation

TOURS

Summer months mean vacation time for many of you with spouses and families. SIAM does encourage that you bring them with you when attending our meetings and conferences. In an attempt to accommodate those who attend, we would like to make a few tours available that may be of interest to newcomers to St. Paul and Minneapolis. Should you be interested in attending one of these tours, just fill in the appropriate spaces on the Advance Registration Form in the back of this brochure and your reservations will be made.

TOUR #1 Hello Twin Cities Tour: Festivities begin when you board your deluxe bus for a lively narrated tour of the Twin Cities. Begin with Nicollet Mall, circle about Hubert Humphrey Metrodome, the Federal Reserve Bank, Orchestra Hall and other outstanding buildings in the center of the city. Refreshments and Danish will be served along the way. Continue on around Loring Park, past the Gutherie Theatre and into the lovely Kenwood residential area. Drive past sparkling city lakes, along green parkways and stop at beautiful Minnehaha falls and enjoy a delicious boxed lunch along the banks. After lunch you will proceed into St. Paul. You'll see the beautiful mansions of Summit Avenue, St. Paul Cathedral and the State Capitol. All are jewels at the end of this historic boulevard. Journey through downtown St. Paul for a glimpse of the main business area, city parks and notable downtown landmarks. Return to the hotel through the campus of the University of Minnesota.

This tour is available on Monday, July 11, 1988. The buses will depart from the Hyatt Regency Lobby at 9:00 AM and return at 2:00 PM. The cost for this tour is $25.00. Space is limited and will be on a first come first served basis.

TOUR #2 Historic Stillwater Tour: Leave the hustle-bustle of the city and head for Stillwater, the first town site in Minnesota on the banks of the wild and beautiful St. Croix River. The history and quaintness of this historic place will come alive as you enjoy refreshments while your guide shares a few stories about this preserved river town. Stroll the streets and browse a little in the Old Post Office Shops, Grand Gallery, Brick Alley, and Staples Mill (antiques). Stop and enjoy lunch on your own at any of the charming restaurants in town; you may wish to pick one with a deck so you can watch the scenic St. Croix River flow by. At the end of a pleasant and refreshing afternoon, board your deluxe motorcoach for your trip back to Minneapolis.

This tour is available on Tuesday, July 12, 1988. The buses will depart from the Hyatt Regency Lobby at 9:00 AM and return at 3:30 PM. The cost for this tour is $20.00. Space is limited and will be on a first come first served basis.

Your confirmations for the above tours will be placed in your registration materials which you pick up upon checking in at the SIAM Registration Desk.

UPCOMING CONFERENCES

March 20–22, 1989
SIAM Conference on Domain Decomposition Methods
Intercontinental Hotel
Houston, TX
Abstract Deadline: September 28, 1988

April 3–5, 1989
Third SIAM Conference on Optimization
57 Park Plaza Hotel
Boston, MA
Abstract Deadline: November 4, 1988

May 17–19, 1989
SIAM Conference on Control and Systems Theory
Cathedral Hill Hotel
San Francisco, CA
Abstract Deadline: December 7, 1988

July 17–21, 1989
1989 SIAM Annual Meeting
Sheraton Harbor Island
San Diego, CA
Abstract Deadline: February 2, 1989

HOTEL RESERVATION FORM

1988 SIAM Annual Meeting

July 11–15, 1988
The Hyatt Regency Hotel, Minneapolis, Minnesota

PLEASE SEND ME A CONFIRMATION NOTICE

Specially discounted rooms are being held for our exclusive use until June 24, 1988. After that date, reservations will depend on availability. Your reservation is not confirmed until acknowledged in writing by the hotel or verified by phone. When making reservations by phone, be certain to identify yourself as an attendee at the 1988 SIAM Annual Meeting. Telephone: 1-612-370-1234.

Name _____ (First) _____ (Last) Phone _____

Address _____

City _____ State _____ Zip _____

Please reserve [ ] Single ($69) [ ] Double ($83) Arrival Date _____

Arrival Time _____ Check-Out Date _____

Guarantee my room for late arrival (after 6:00 PM) [ ] Yes [ ] No

I choose to pay by:* [ ] AMEX [ ] VISA [ ] MC [ ] Check

Credit Card Number _____

Expiration Date _____ Deposit $_____ (Late Arrivals Only)

Signature _____

If you list your credit card number, please enclose this card in an envelope and mail to: Reservations, The Hyatt Regency Hotel, On Nicollet Mall, 1300 Nicollet Mall, Minneapolis, MN 55403.

* You only need to list your credit card number if you want to guarantee your room for late arrival.

ADVANCE REGISTRATION FORM

1988 SIAM Annual Meeting

*Advance registration form must be received at the SIAM office by July 7, 1988. If paying by check, please make check payable to SIAM.

REGISTRATION FEES:

		SIAM Member	Non Member	Student
Short Course	Advance	$ 95	$115	$55
	On-Site	$115	$135	$75
Meeting	Advance	$ 90	$110	$15
	On-Site	$110	$130	$15

Registration Fee	$____	$____	$____
Beer Party $15.00	$____	$____	$____
Dinner/River Cruise $28.00	$____	$____	$____
Spouse Tour #1 $25.00	$____	$____	$____
Spouse Tour #2 $20.00	$____	$____	$____
Total	$____	$____	$____

Detach card and enclose with payment in the envelope provided (domestic mail only), or mail to: SIAM, 117 South 17th Street, 14th floor, Philadelphia, PA 19103-5052. Telephone: 215-564-2929.

Name _____ (First) (please print) (Last)

Affiliation _____

Department _____

Address _____

City _____ State _____ Zip _____

Telephone Number _____

Local Address in Minneapolis _____

I wish to pay by [ ] AMEX [ ] VISA [ ] MC [ ] Check

Credit Card Number _____ Expiration Date _____

Signature _____

I am a member of [ ] SIAM [ ] Other(s) _____

[ ] Please send me information about SIAM Membership