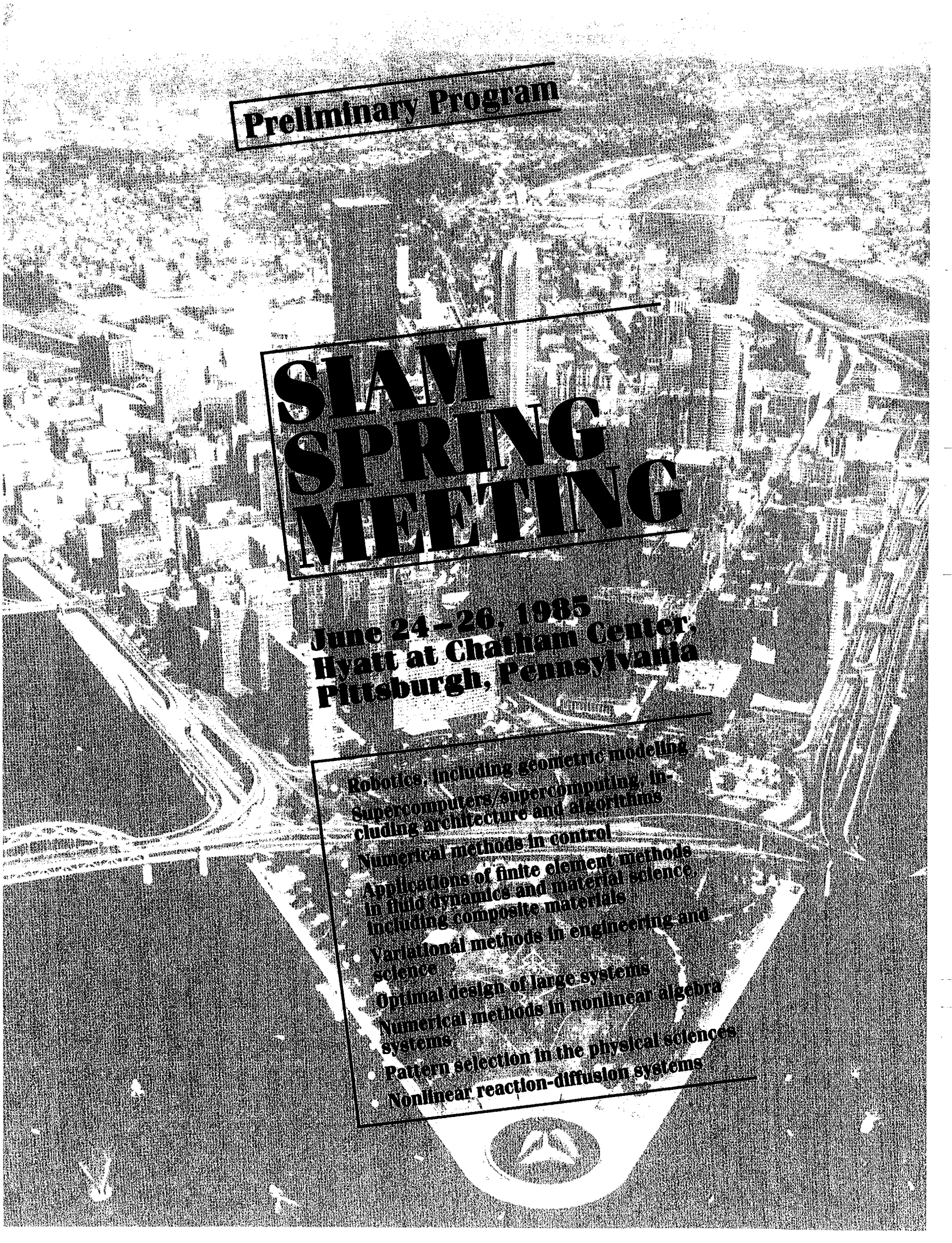


Preliminary Program

# SIAM SPRING MEETING

## June 24–26, 1985
## Hyatt at Chatham Center, Pittsburgh, Pennsylvania

- Robotics, including geometric modeling
- Supercomputers/supercomputing, including architecture and algorithms
- Numerical methods in control
- Applications of finite element methods in fluid dynamics and material science, including composite materials
- Variational methods in engineering and science
- Optimal design of large systems
- Numerical methods in nonlinear algebra systems
- Pattern selection in the physical sciences
- Nonlinear reaction-diffusion systems

## TABLE OF CONTENTS



## ORGANIZING COMMITTEE



## FUNDING AGENCIES


SIAM is conducting this meeting with the partial support of the Air Force Office of Scientific Research, the Army Research Office, the Department of Energy, and the National Science Foundation.

*Cover photographs graciously provided by the Greater Pittsburgh Convention and Visitors Bureau.*


## MEETING HIGHLIGHTS

### Invited Presentations

*Monday, June 24, 8:30 AM*
Invited Presentation 1
**NONCONVEX PROBLEMS IN HOMOGENIZATION WITH APPLICATIONS TO COMPOSITE MATERIALS**

Composite materials are of great technological importance because of their light weight and high strength. On the other hand, they cause considerable problems in design because their rich microstructure makes them difficult to analyze by conventional finite element methods.

The speaker will show how homogenization can be used to predict the effective properties of composite materials. That permits the optimization of the composite design, which initially leads to nonconvex variational problems whose minimizing sequences display rapid oscillations. The "macro level" design problems can then be treated by relaxed, or convexified, approaches that are numerically well-posed. A number of applications and examples will be discussed.

Gilbert Strang
Department of Mathematics
Massachusetts Institute of Technology
Cambridge, MA

*Monday, June 24, 9:15 AM*
Invited Presentation 2
**PATTERN SELECTION IN NONLINEAR REACTION-DIFFUSION SYSTEMS**

Pattern selection is a subject of wide and increasing interest to biologists, chemists and physicists. In studying such phenomena, reaction-diffusion systems are proving to be useful mathematical models because of the large number of nonlinear effects they introduce.

One model consists of two reaction-diffusion equations, one of which has a small diffusion coefficient. When the latter is zero, the mathematical equations have a continuum of stable discontinuous steady-state solutions, i.e. patterns. The issue is: which one is physically relevant?

The speaker will show that when the diffusion coefficient is sufficiently small, any one of these patterns is the apparent limit of some class of solutions. In fact, there is no equilibrium, stable or unstable, near this pattern, and the pattern eventually disappears, a phenomenon reminiscent of the behavior of certain chemical reactions such as the Belousov-Zhabotinsky reaction. The speaker will illustrate the phenomenon in models from population biology where there is interaction between competing species.

Hans F. Weinberger
Institute for Mathematics and Its Applications
University of Minnesota
Minneapolis, MN

*Monday, June 24, 2:00 PM*
Invited Presentation 3
**THE PARTICLE METHOD AND SOME APPLICATIONS TO FLUID DYNAMICS**

The particle method is a numerical method of growing importance in fluid mechanics and in physics. In particular, it provides a very effective way of stimulating very complex convection-dominated flows for both compressible and incompressible fluids. In physics, the method is fairly well adapted to the numerical solution of kinetic equations. In fact, the particle method has been recently recognized as a general method of approximation of partial differential equations which generalizes the classical finite difference method.

The speaker will present a survey of some of the mathematical features of the particle method and discuss some applications to fluid dynamics. Emphasis will be placed on two types of problems—convection-diffusion equations and Euler equations for a compressible fluid.

Pierre A. Raviart
Université Pierre et Marie Curie
Paris, France

*Tuesday, June 25, 8:30 AM*
Invited Presentation 4
**MATHEMATICAL OPPORTUNITIES IN AUTOMATED MANUFACTURING**

Mathematical analysis has been one of the unappreciated critical activities in the worldwide drive to increase manufacturing productivity. Areas where mathematicians are already making contributions include geometric modeling, graphics and robotics.

Based on his extensive experience as an industry executive and academic leader in automated manufacturing, the speaker will target opportunities where mathematical and computational methods might play an even greater role.

Daniel Berg, Provost
Rensselaer Polytechnic Institute
Troy, NY 12181

*Tuesday, June 25, 9:15 AM*
Invited Presentation 5
**OBSTACLE AVOIDANCE IN ROBOTICS**

Research in robotics has exposed a number of real problems that appear susceptible to mathematical solution. One of these is the problem of obstacle avoidance that involves a large combinatorial search in three-dimensional space. In such searches the principal task is to determine whether the robot is trying to occupy the space already occupied by the obstacle. In the approach taken, the space is subdivided into finer and finer cubes until the obstacle is located. The number of computations increases exponentially as a function of the size of the cube. The speaker will describe a number of techniques for reducing the computational complexity of the search.

Raj Reddy
Robotics Institute
Carnegie-Mellon University
Pittsburgh, PA

*Tuesday, June 25, 2:00 PM*
The John von Neumann Lecture
**CONFIGURAL POLYSAMPLING**

In the simple problem of location and scale we do not know how our observations $\{y_i\}$ are related to the location, $\mu$, and scale $\sigma$ of some underlying distribution. The equivalence class of all n-tuples $\{A + By_i\}$, which can be represented by that one of its elements $\{c_i\}$ that is subject to any two linear constraints, has the same relation to the distribution $F((y - \mu)/\sigma)$ for all $\mu$ and $\sigma$. Thus it has long been natural to think of inference "conditional on the configuration". Pitman dealt with the resulting problem for a single F( ) in 1939. To deal with problems involving two or more F( )'s, it is most helpful to be able to treat both samples and configurations, appropriately weighted, as random from two or more F( )'s.

Considerable gain in both computational efficiency and understanding come from using such configural polysampling to study robustness of estimation in a variety of problems.

John W. Tukey
Department of Statistics
Princeton University
Princeton, NJ
and
AT&T Bell Laboratories
Murray Hill, NJ

*Wednesday, June 26, 8:30 AM*
Invited Presentation 6
**ADVANCES IN SOLVING THE NONLINEAR EVOLUTION EQUATIONS OF CONTINUUM PHYSICS**

Continuum mechanics is rich in nonlinear phenomena. From a technological view, one of the most important is the appearance of shock waves. They appear in diverse applications such as the flow of air or gas over an airfoil and the large vibrations of complicated structures. Mathematically, a shock wave represents a region where the classical notion of a solution is no longer valid. Thus, the field equations must be supplemented with extra conditions on the shocks to insure existence and uniqueness. The development of mathematically rigorous and physically relevant shock conditions is of major importance in applications, particularly in numerical simulations. For simple problems—for example, gas dynamics in one spatial dimension—these conditions have been obtained and are generally called entropy conditions.

## Invited Presentations

The speaker will survey the progress to date in more general settings. This is an area where mathematical rigor and physical intuition blend in an unusually intriguing manner.

Constantine M. Dafermos
Applied Mathematics Division
Brown University
Providence, RI

*Wednesday, June 26, 9:15 AM*
Invited Presentation 7
**SYMMETRY BREAKING IN MATHEMATICAL PROBLEMS OF BIOLOGY AND PHYSICS**

Symmetry breaking is a phenomenon that appears widely in nature where there is sudden transition from smooth and regular behavior to a chaotic state. For example, in the flow past a sphere at moderate free-stream velocities, symmetric vortices appear behind the sphere. As the free-stream velocity is increased, this symmetry breaks up into a chaotic and turbulent flow pattern. Such problems are receiving the increasing attention of biologists, chemists, engineers and physicists.

The speaker will describe such mechanisms in nonlinear reaction-diffusion systems and explain how they arise and when they occur.

Joel Smoller
Department of Mathematics
The University of Michigan
Ann Arbor, MI

*Wednesday, June 26, 2:00 PM*
Invited Presentation 8
**GROUP RENORMALIZATION METHODS FOR TURBULENT FLOWS**

Group renormalization methods have been used with great success in dealing with systems having complex microstructures in a number of areas of modern physics. The idea is to decompose such a system into groups and average appropriate functionals over these groups to obtain a simple large-scale description of the system.

The speaker will discuss the application of these ideas to turbulent flows where motions exist on all scales and the application of group renormalization techniques averages out to small-scales that yield a transport approximation providing an aggregate description of the flow. He will also discuss a number of applications involving turbulent shear flows.

Steven A. Orszag
Department of Computer Science
Princeton University
Princeton, NJ

## Minisymposia

1. **NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS I**
R. A. Nicolaides
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

2. **SUPERCOMPUTER—ALGORITHMS AND APPLICATIONS—Part 1 of 2**
(Sponsored by the SIAM Activity Group on Supercomputing)
Jack J. Dongarra
Mathematics and Computer Science Division
Argonne National Laboratory
Argonne, IL

3. **FOUR NEW PROBLEMS AND ALGORITHMS**
Richard J. Duffin
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

4. **PATTERN SELECTION IN SOLIDIFICATION PHENOMENA**
David J. Wollkind
Department of Pure and Applied Mathematics
Washington State University, Pullman, WA

5. **COMBINATORICS AND GRAPH THEORY—Part 1 of 2**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
William T. Trotter, Jr.
Department of Mathematics and Statistics
University of South Carolina, Columbia, SC

6. **MODELS FOR SPATIAL AND TEMPORAL PATTERNS IN BIOLOGICAL SYSTEMS**
Leah Edelstein-Keshet
Department of Mathematics
Duke University, Durham, NC

7. **GRADIENT AND FINITE ELEMENT TECHNIQUES IN OPTIMAL CONTROL—Part 1 of 2**
Caulton L. Irwin
Department of Mathematics
West Virginia University, Morgantown, WV

8. **COMBINATORICS AND GRAPH THEORY—Part 2 of 2**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
William T. Trotter, Jr.
Department of Mathematics and Statistics
University of South Carolina, Columbia, SC

9. **MATHEMATICAL QUESTIONS IN ROBOTICS**
Samuel P. Marin
Department of Mathematics
General Motors Research Laboratories, Warren, MI

10. **NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS II**
James Boland and Janet Peterson
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

11. **GLOBAL METHODS FOR NONLINEAR SYSTEMS OF EQUATIONS**
Layne T. Watson
Department of Computer Science
Virginia Polytechnic Institute and State University
Blacksburg, VA
and
Alexander P. Morgan
Department of Mathematics
General Motors Research Laboratories, Warren, MI

12. **OPTIMIZATION OF LARGE ENGINEERING SYSTEMS**
Vadim Komkov
Department of Mathematics
Winthrop College, Rockhill, SC

13. **LATTICE ALGORITHMS AND THEIR APPLICATIONS**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
R. Kannan
Department of Computer Science
Carnegie-Mellon University, Pittsburgh, PA
and
Nimrod Megiddo
IBM Research Laboratory
San Jose, CA

14. **GRADIENT AND FINITE ELEMENT TECHNIQUES IN OPTIMAL CONTROL—Part 2 of 2**
Caulton L. Irwin
Department of Mathematics
West Virginia University, Morgantown, WV

15. **DEMONSTRATIONS OF LINEAR ALGEBRA SOFTWARE FOR MICROCOMPUTERS—Part 1 of 2**
(Sponsored by the SIAM Activity Group on Linear Algebra)
Robert C. Ward
Mathematical Sciences
Oak Ridge National Laboratory, Oak Ridge, TN

16. **DIFFERENTIAL ALGEBRAIC EQUATION SYSTEMS**
Thomas A. Porsching
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

17. **MATHEMATICAL MODELS IN ECOTOXICOLOGY**
(Sponsored by SIAM Institute for Mathematics and Society)
Thomas G. Hallam
Department of Mathematics and Program in Ecology
University of Tennessee, Knoxville, TN

18. **SUPERCOMPUTER—ALGORITHMS AND APPLICATIONS—Part 2 of 2**
(Sponsored by the SIAM Activity Group on Supercomputing)
Jack J. Dongarra
Mathematics and Computer Science Division
Argonne National Laboratory, Argonne, IL

19. **NUMERICAL APPROXIMATION**
M. J. Marsden and A. R. Reddy
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

20. **DEMONSTRATIONS OF LINEAR ALGEBRA SOFTWARE FOR MICROCOMPUTERS—Part 2 of 2**
(Sponsored by the SIAM Activity Group on Linear Algebra)
Robert C. Ward Mathematical Sciences
Oak Ridge National Laboratory, Oak Ridge, TN

## Special Functions

**Welcoming Reception**
*Sunday, June 23, 8:00 pm*
Second Floor Ballroom Level

A convenient place to meet your colleagues before the meeting. No-host bar.

**Wine and Cheese Party**
*Monday, June 24, 7:00 pm*
Second Floor Ballroom Level

An evening get-together featuring carafes of wine and imported breads and cheeses. $10.00

**Dinner Cruise**
*Tuesday, June 25, 6:30 pm*

There will be a hotel pick-up for the short ride to and from the docks.

Join us for a pleasant evening on Pittsburgh's three rivers aboard a paddle wheel riverboat. Enjoy a cocktail on deck before dinner and then retire below for chicken and ribs with a view of the many sights that surround the city. $16.00

# PROGRAM-AT-A-GLANCE

## Sunday, June 23/PM

*5:00 PM*
**Registration Opens**
Foyer, Second Floor Ballroom Level

*8:00 PM*
**Welcoming Reception**
Foyer, Second Floor Ballroom Level

*10:00 PM*
**Registration Closes**

## Monday, June 24/AM

*7:30 AM*
**Registration Opens**
Foyer, Second Floor Ballroom Level

*8:15 AM*/Room 1
**Opening Remarks**

*8:30 AM*/Room 1
**Invited Presentations 1 and 2**
Chairman: R. A. Nicolaides
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

**NON-CONVEX PROBLEMS IN HOMOGENIZATION WITH APPLICATIONS TO COMPOSITE MATERIALS**
Gilbert Strang
Department of Mathematics
Massachusetts Institute of Technology, Cambridge, MA

**PATTERN SELECTION IN NONLINEAR REACTION-DIFFUSION SYSTEMS**
Hans F. Weinberger
Institute for Mathematics and Its Applications
University of Minnesota, Minneapolis, MN

*10:00 AM*/Coffee

*10:30 AM/CONCURRENT SESSIONS*

Minisymposium 1/Room 4
**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS I**
Chairman: R. A. Nicolaides
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

Minisymposium 2/Room 7
**SUPERCOMPUTER — ALGORITHMS AND APPLICATIONS**
(Sponsored by the SIAM Activity Group on Supercomputing)
Chairman: Jack J. Dongarra
Mathematics and Computer Science Division
Argonne National Laboratory Argonne, IL

Minisymposium 3/Room 1
**FOUR NEW PROBLEMS AND ALGORITHMS**
Chairman: Richard J. Duffin
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

Minisymposium 4/Room 3
**PATTERN SELECTION IN SOLIDIFICATION PHENOMENA**
Chairman: David J. Wollkind
Department of Pure and Applied Mathematics
Washington State University, Pullman, WA

Minisymposium 5/Room 5
**COMBINATORICS AND GRAPH THEORY — Part 1 of 2**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
Chairman: William T. Trotter, Jr.
Department of Mathematics and Statistics
University of South Carolina, Columbia, SC

Contributed Papers 1/Room 6
**ORDINARY DIFFERENTIAL AND INTEGRAL EQUATIONS**
Chairman: B. Ermentrout
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

Contributed Papers 2/Chatham A
**CONTROL THEORY**
Chairman: J. Leightbourne
Department of Mathematics
West Virginia University, Morgantown, WV

## Monday, June 24/PM

*12:30 PM*/Lunch

*2:00 PM*/Room 1
**Invited Presentation 3**
Chairman: Max D. Gunzburger
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

**THE PARTICLE METHOD AND SOME APPLICATIONS TO FLUID DYNAMICS**
Pierre A. Raviart
Université Pierre et Marie Curie, Paris, France

*2:45 PM*/Coffee

*3:15 PM*/CONCURRENT SESSIONS

Minisymposium 6/Room 1
**MODELS FOR SPATIAL AND TEMPORAL PATTERNS IN BIOLOGICAL SYSTEMS**
Chairman: Leah Edelstein-Keshet
Department of Mathematics
Duke University, Durham, NC

Minisymposium 7/Room 4
**GRADIENT AND FINITE ELEMENT TECHNIQUES IN OPTIMAL CONTROL — Part 1 of 2**
Chairman: Caulton L. Irwin
Department of Mathematics
West Virginia University, Morgantown, WV

Minisymposium 8/Room 7
**COMBINATORICS AND GRAPH THEORY — Part 2 of 2**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
Chairman: William T. Trotter, Jr.
Department of Mathematics and Statistics
University of South Carolina, Columbia, SC

Contributed Papers 3/Room 5
**FLUID DYNAMICS**
Chairman: I. Alexander
Department of Physics and Mathematics
Carnegie-Mellon University, Pittsburgh, PA

Contributed Papers 4/Room 3
**LINEAR AND NONLINEAR EQUATIONS**
Chairman: S. Rankin
Department of Mathematics
West Virginia University, Morgantown, WV

Contributed Papers 5/Room 6
**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**
Chairman: E. Overman
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

*7:00 PM*
**Wine and Cheese Party**
Foyer, Second Floor Ballroom Level

## Tuesday, June 25/AM

*8:30 AM*/Room 1
**Invited Presentations 4 and 5**
Chairman: George J. Fix
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

**MATHEMATICAL OPPORTUNITIES IN AUTOMATED MANUFACTURING**
Daniel Berg, Provost
Rensselaer Polytechnic Institute
Troy, NY

**OBSTACLE AVOIDANCE IN ROBOTICS**
Raj Reddy
Robotics Institute
Carnegie-Mellon University, Pittsburgh, PA

*10:00 AM*/Coffee

*10:30 AM*/CONCURRENT SESSIONS

Minisymposium 9/Chatham A
**MATHEMATICAL QUESTIONS IN ROBOTICS**
Chairman: Samuel P. Marin
Department of Mathematics
General Motors Research Laboratories, Warren, MI

Minisymposium 10/Room 4
**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS II**
Chairmen: James Boland and Janet Peterson
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

Minisymposium 11/Room 5
**GLOBAL METHODS FOR NONLINEAR SYSTEMS OF EQUATIONS**
Chairmen: Layne T. Watson
Department of Computer Science
Virginia Polytechnic Institute and State University
Blacksburg, VA

Alexander P. Morgan
Department of Mathematics
General Motors Research Laboratories, Warren, MI

Minisymposium 12/Room 1
**OPTIMIZATION OF LARGE ENGINEERING SYSTEMS**
Chairman: Vadim Komkov
Department of Mathematics
Winthrop College, Rockhill, SC

## TUESDAY, JUNE 25 (CONCURRENT)

**One-Day Program on Mathematics for High School Education**
SIAM will conduct a program for high school mathematics teachers in the Pittsburgh area and for SIAM members interested in participating in mathematics education programs for high schools. The program will feature a film series featuring men and women in careers depending on mathematics, an industry forum where industry representatives will explain the uses of mathematics and the role of mathematics at their respective companies, and a panel of industrial mathematicians on what it's really like to solve mathematical problems in industry.

There will be a luncheon for the teachers and a luncheon speaker.

Following the luncheon, the teachers will join with SIAM members to attend The John von Neumann Lecture.

*8:30 AM*
**Film Series**

**Mathematics at Work in Society**
Twenty-minute television video tapes, distributed by the Mathematical Association of America, featuring men and women in careers depending on mathematics. An industrial mathematician will discuss the films and answer questions.

Chairman
Lynn O. Wilson
AT&T Bell Laboratories, Murray Hill, NJ

**An Actuary — What's That?**
Actuaries and others at a large life insurance company describe the mathematics needed for the insurance business.

**Mathematics in Space**
Employees at NASA's Johnson Space Center talk about the mathematics needed to prepare space flights.

**Mathematics: The Language of Research**
An applied mathematician at Bell Laboratories describes her research on integrated circuits.

## Tuesday, June 25/PM

*12:30 PM/*Lunch

*2:00 PM/*Room 1
**The John von Neumann Lecture**
Chairman: Gene H. Golub
Department of Computer Science
Stanford University, Stanford, CA

**CONFIGURAL POLYSAMPLING**
John W. Tukey
Department of Statistics
Princeton University, Princeton, NJ
and
AT&T Bell Laboratories
Murray Hill, NJ

*3:00 PM/*Coffee

*3:30 PM/CONCURRENT SESSIONS*

Minisymposium 13/Room 4
**LATTICE ALGORITHMS AND THEIR APPLICATIONS**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
Chairmen: R. Kannan
Department of Computer Science
Carnegie-Mellon University, Pittsburgh, PA
and
Nimrod Megiddo
IBM Research Laboratory
San Jose, CA

Minisymposium 14/Room 1
**GRADIENT AND FINITE ELEMENT TECHNIQUES IN OPTIMAL CONTROL — Part 2 of 2**
Chairman: Caulton L. Irwin
Department of Mathematics
West Virginia University, Morgantown, WV

Contributed Papers 6/Room 5
**COMPUTATIONAL FLUID DYNAMICS**
Chairman: M. Sussman
Bettis Atomic Power Laboratory
Westinghouse Corporation, West Mifflin, PA

Contributed Papers 7/Chatham A
**OPTIMIZATION ROBOTICS**
Chairman: I. Abu-Hsumays
Bettis Atomic Power Laboratory
Westinghouse Corporation, West Mifflin, PA

**POSTER SESSION 1**/Room 6

*6:30 PM*
**Dinner Cruise**
(Pick-up at the hotel)

## Wednesday, June 26/AM

*8:30 AM/*Room 1
**Invited Presentations 6 and 7**
Chairman: Thomas A. Porsching
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

**ADVANCES IN SOLVING THE NONLINEAR EVOLUTION EQUATIONS OF CONTINUUM PHYSICS**
Constantine M. Dafermos
Applied Mathematics Division
Brown University, Providence, RI

**SYMMETRY BREAKING IN MATHEMATICAL PROBLEMS OF BIOLOGY AND PHYSICS**
Joel Smoller
Department of Mathematics
University of Michigan, Ann Arbor, MI

*10:00 AM/*Coffee

*10:00 AM/***SIAM Business Meeting**
Chatham 10 (10th Floor)

*10:30 AM/*CONCURRENT SESSIONS

Minisymposium 15/Room 7
**DEMONSTRATIONS OF LINEAR ALGEBRA SOFTWARE FOR MICROCOMPUTERS — Part 1 of 2**
(Sponsored by the SIAM Activity Group on Linear Algebra)
Chairman: Robert C. Ward
Mathematical Sciences
Oak Ridge National Laboratory, Oak Ridge, TN

Minisymposium 16/Room 1
**DIFFERENTIAL ALGEBRAIC EQUATION SYSTEMS**
Chairman: Thomas A. Porsching
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

Minisymposium 17/Chatham A
(Sponsored by SIAM Institute for Mathematics and Society)
**MATHEMATICAL MODELS IN ECOTOXICOLOGY**
Chairman: Thomas G. Hallam
Department of Mathematics and Program in Ecology
University of Tennessee, Knoxville, TN

Minisymposium 18/Room 4
**SUPERCOMPUTER — ALGORITHMS AND APPLICATIONS — Part 2 of 2**
(Sponsored by the SIAM Activity Group on Supercomputing)
Chairman: Jack J. Dongarra
Mathematics and Computer Science Division
Argonne National Laboratory, Argonne, IL

Contributed Papers 8/Room 3
**NUMERICAL ORDINARY DIFFERENTIAL AND INTEGRAL EQUATIONS**
Chairman: C. Cullen
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

Contributed Papers 9/Room 5
**PARTIAL DIFFERENTIAL EQUATIONS**
Chairman: J. Schaeffer
Department of Mathematics
Carnegie-Mellon University, Pittsburgh, PA

Contributed Papers 10/Room 6
**FINITE ELEMENT METHODS**
Chairman: Janet Peterson
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

## Wednesday, June 26/PM

*12:30 PM/*Lunch

*2:00 PM/*Room 1
**Invited Presentation 8**
Chairman: Charles A. Hall
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

**GROUP RENORMALIZATION METHODS FOR TURBULENT FLOWS**
Steven A. Orszag
Department of Computer Science
Princeton University, Princeton, NJ

*2:45 PM/*Coffee

*3:00 PM/*CONCURRENT SESSIONS

Minisymposium 19/Room 4
**NUMERICAL APPROXIMATION**
Chairmen: M. J. Marsden and A. R. Reddy
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

Minisymposium 20/Room 7
**DEMONSTRATIONS OF LINEAR ALGEBRA SOFTWARE FOR MICROCOMPUTERS — Part 2 of 2**
(Sponsored by the SIAM Activity Group on Linear Algebra)
Chairman: Robert C. Ward
Mathematical Sciences
Oak Ridge National Laboratory, Oak Ridge, TN

Contributed Papers 11/Room 1
**ELASTICITY**
Chairman: C. Caldwell
Bettis Atomic Power Laboratory
Westinghouse Corporation, West Mifflin, PA

Contributed Papers 12/Room 5
**COMBINATORICS/STOCHASTICS**
Chairman: J. Fink
Department of Mathematics and Statistics
University of Pittsburgh, Pittsburgh, PA

Contributed Papers 13/Room 6
**NUMERICAL AND ASYMPTOTIC METHODS**
Chairman: J. Moseley
Department of Mathematics
West Virginia University, Morgantown, WV

## Tuesday, June 25 (Concurrent)

**Mathematics: Where Will I Ever Use It?**
A high school mathematics teacher talks about the rewards of her job and what it takes to be a good teacher. Other mathematics-dependent careers featured on this tape are the meteorologist, entymologist, geologist, carpenter, architect, and nurse.

Tapes will be shown continuously in the order indicated.

*10:00 AM*
**Coffee**

*10:30 AM*
Industrial mathematicians, armed with posters, flip charts, and other audio/visual aids, will be available to discuss the work their organizations are doing that involve mathematics and to answer questions about training that young people need to prepare themselves for positions in government and industry.

Representatives will be announced.

*12:00 NOON*
**Luncheon for High School Mathematics Teachers**

Speaker to be announced.

*2:00 PM*
**The John von Neumann Lecture**

**"CONFIGURAL POLYSAMPLING"**
John W. Tukey
Department of Statistics
Princeton University
Princeton, NJ
and
AT&T Bell Laboratories
Murray Hill, NJ

*3:00 PM*
**Panel Discussion**

**Problem Solving: What It's Really Like**

Industrial representatives relate personal experiences involving the use of mathematics in industry. There will be ample opportunity for questions and discussions — What are the implications for mathematics education? Who uses mathematics and how? How do you show that mathematics is exciting? How can SIAM help?

Chairman and Organizer
Lynn O. Wilson
AT&T Bell Laboratories
Murray Hill, NJ

Peter E. Castro
Eastman Kodak Company
Rochester, NY

John N. Johnson
Boeing Computer Services
Seattle, WA

David H. Withers
IBM-Thomas J. Watson Research Center
Yorktown Heights, NY

*5:00 PM/*Adjourn

# MINISYMPOSIA

Monday, June 24/*10:30 AM*
Minisymposium 1/*Room 4*
**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS I**
This symposium will focus on recent developments in the numerical solution of elliptic equations. The speakers will discuss adaptive mesh generation, multigrid methods, and improved conjugate gradient algorithms. These topics remain at the forefront of research in partial differential equations, and the symposium is designed to reflect this situation.

CHAIRMAN AND ORGANIZER
R. A. Nicolaides
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

**Error Estimators and Adaptive Mesh Refinement**
Randolph E. Bank
University of California, San Diego
La Jolla, CA

**Multilevel Solution of Boundary Value Problems**
Craig Douglas
Department of Computer Science
Duke University
Durham, NC

**Some Successes and Failures of Factorization Preconditioners**
Howard Elman
Department of Computer Science
Yale University
New Haven, CT

**Deflated Conjugate Gradients**
R. A. Nicolaides
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

Monday, June 24/*10:30 AM*
Minisymposium 2/*Room 7*
**SUPERCOMPUTER—ALGORITHMS AND APPLICATIONS I (2 parts)**
(Sponsored by the SIAM Activity Group on Supercomputing)
Supercomputing plays an important role in many areas of science and engineering but is most often required in the execution of large-scale simulation and design problems. High-speed processors enable the scientist and engineer to treat complexity in models that are not otherwise tractable, and study phenomena that cannot be studied under laboratory conditions. Hence the greatest value of high speed computers lies in their ability to handle larger sets of computationally tractable problems. In these minisymposia various areas of supercomputing will be investigated.

CHAIRMAN AND ORGANIZER
Jack J. Dongarra
Mathematics and Computer Science Division
Argonne National Laboratory
Argonne, IL

**Higher Dimensional Riemann Problems: Nonlinear Wave Interactions**
James G. Glimm
Courant Institute of Mathematical Sciences
New York University
New York, NY

**Relating the Structures of Problems, Algorithms and Machines**
Joseph Oliger
Department of Computer Science
Stanford University
Stanford, CA

**Decomposition Techniques for Partial Differential Equations**
Garry Rodrigue
Computing Research Group
Lawrence Livermore National Laboratory
Livermore, CA

**1 Supercomputer + 3 Dimensions = Too Much Data**
D. L. Dwoyer
NASA Langley Research Center
Hampton, VA

Robert G. Voigt
ICASE
NASA Langley Research Center
Hampton, VA

Monday, June 24/*10:30 AM*
Minisymposium 3/*Room 1*
**FOUR NEW PROBLEMS AND ALGORITHMS**
This symposium will focus on new problems arising in science and technology. It will also treat new algorithms for approximate solutions of older problems: (1) new problems have arisen in passive solar heating and their treatment by optimal phase shift filters. (2) studies by Robert Griffiths in thermal physics led to the concept of "additive eigenvalues." (3) new algorithms are needed for higher derivative approximation in the numerical solution of differential equations. (4) a related problem concerns inequalities for the higher derivatives of Haar generalized polynomials of a given "degree."

CHAIRMAN AND ORGANIZER
R. J. Duffin
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

**Minimizing the Daily Swing of Temperature Inside a Building by Use of Layered Walls**
Greg Knowles
Department of Mathematics
Heriot-Watt University
Riccarton, Edinburgh, Scotland

**Finding Griffiths Additive Eigenvalues by Linear Programming**
(To be presented by the chairman and organizer)

**Minimizing Approximational Error in Finding Higher Derivatives of Partial Differential Equations**
Peter Hoffman
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

**Extending the Markoff-Duffin-Schaeffer Inequalities to Generalized Polynomials**
L. A. Karlovitz
College of Science and Liberal Studies
Georgia Institute of Technology
Atlanta, GA

Monday, June 24/*10:30 AM*
Minisymposium 4/*Room 3*
**PATTERN SELECTION IN SOLIDIFICATION PHENOMENA**
Investigators of problems in nonlinear hydrodynamic stability theory are aware of the fact that their methods can be adapted so that they apply to a broad class of physical phenomena. The controlled or spontaneous solidification of a pure substance or binary mixture under the influence of imposed temperature and/or solute gradients is such a phenomenon.

This minisymposium focuses on the morphological stability aspect of pattern formation from certain basic solid-liquid interfacial shapes which are initially growing uniformly. The four speakers will survey results obtained by a variety of fluid mechanical methods, both of an analytical and numerical nature, applied to particular two and three-dimensional solidification models.

CHAIRMAN AND ORGANIZER
David J. Wollkind
Department of Pure and Applied Mathematics
Washington State University
Pullman, WA

**On Pattern Formation Subsequent to Morphological Instability**
Robert Floyd Sekerka
Mellon College of Science
Carnegie-Mellon University
Pittsburgh, PA

**Nonplanar Interface Morphologies During Unidirection-Solidification of a Binary Alloy**
G. B. McFadden and R. F. Boisvert
Center for Applied Mathematics
National Bureau of Standards
Gaithersburg, MD

S. R. Coriell
Center for Materials Science
National Bureau of Standards
Gaithersburg, MD

**The Formation of Deep Cellular Melt/Solid Interfaces in Directional Solidification**
Lyle H. Ungar
Department of Chemical Engineering
University of Pennsylvania
Philadelphia, PA

Robert A. Brown
Department of Chemical Engineering
Massachusetts Institute of Technology
Cambridge, MA

**Pattern Selection During Alloy Solidification: Comparison with the Be'nard Problem**
(To be presented by the chairman and organizer)

Monday, June 24/*10:30 AM and 3:15 PM*
Minisymposia 5 and 8/*(Rooms 5 and 7 respectively)*
**COMBINATORICS AND GRAPH THEORY (2 parts)**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
This is the first session organized by the new SIAM Activity Group on Discrete Mathematics. Participants will present the results of recent research in combinatorics and graph theory including work on intersection graphs, graph factorization—The Oberwolfach Problem, nonnegative matrices and spectral radii, extremal problems for posets, and Ramsey theory for graphs. Open problems and directions for future research will also be discussed.

CHAIRMAN AND ORGANIZER
William T. Trotter, Jr.
Department of Mathematics and Statistics
University of South Carolina
Columbia, SC

**The Oberwolfach Problem**
Brian R. Alspach
Department of Mathematics
Simon Fraser University
Burnaby, BC, Canada

**Multipartite Graph-Tree Ramsey Numbers**
Ralph J. Faudree, R. H. Schelp, C. C. Rousseau
Department of Mathematical Sciences
Memphis State University
Memphis, TN
and

Paul Erdos
Mathematical Institute
Hungarian Academy of Sciences
Budapest, Hungary

**Intersection Graphs of Paths in a Tree**
Clyde L. Monma
AT&T Bell Laboratories
Bell Communications Research
Holmdel, NJ

**The Largest Ranked Suborder of a Partial Order**
Michael Saks
Department of Mathematics
Rutgers University
New Brunswick, NJ

**Generalized Book-Tree Ramsey Numbers**
R. J. Faudree, C. C. Rousseau, and R. H. Schelp
Department of Mathematical Sciences
Memphis State University
Memphis, TN

**Tight Bounds on the Spectral Radius of Nonnegative Asymmetric Matrices**
Allen Schwenk
Mathematical Sciences Division
Office of Naval Research
Arlington, VA

Monday, June 24*/3:15 PM*
Minisymposium 6*/Room 1*
**MODELS FOR SPATIAL AND TEMPORAL PATTERNS IN BIOLOGICAL SYSTEMS**
In a series of talks on reaction-diffusion systems, biological oscillators, and related phenomena, we will explore models for a number of mechanisms responsible for generating spatial and temporal patterns in biological systems. Examples of temporal patterns in coupled oscillators (B. Ermentrout) and neuronal dynamics (P. Rapp) will be described. Results on piece-wise linear prototypes of activator-inhibitor systems (Z. Kadas), on molecular sorting by differential diffusion (D. Lauffenburger), will demonstrate the role of diffusion in spatial patterns. Finally, the fact that spatial and temporal patterns can be interrelated will be illustrated by a model for branching networks (L. Edelstein-Keshet).

CHAIRMAN AND ORGANIZER
Leah Edelstein-Keshet
Department of Mathematics
Duke University
Durham, NC

**Chains of Coupled Oscillators**
Bard Ermentrout
Department of Mathematics
University of Pittsburgh
Pittsburgh, PA

Nancy Kopell
Department of Mathematics
Northeastern University
Boston, MA

**On Populations That Disperse to Avoid Crowding**
Morton E. Gurtin
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

**Topological Analysis of Cortical Activity**
Paul E. Rapp
Department of Physiology and Biochemistry
Medical College of Pennsylvania
Philadelphia, PA

**Analysis of Intracellular Receptor-Ligand Sorting by CURL**
Douglas Lauffenburger and Jeniffer Linderman
Department of Chemical Engineering
University of Pennsylvania
Philadelphia, PA

**A Piecewise-Linear Activator-Inhibitor Model**
Zsuzsanna M. Kadas
Department of Mathematics and Statistics
University of Vermont
Burlington, VT

**Spatial Patterns in Networks and in Butterfly Wings**
(To be presented by the chairman and organizer)

Monday, June 24*/3:15 PM*
Minisymposium 7*/Room 4*
**GRADIENT AND FINITE ELEMENT TECHNIQUES IN OPTIMAL CONTROL I (2 parts)**
The purpose of the minisymposium is to review recent developments in algorithmic techniques for solving optimal control/design/estimation problems. Gradient, finite element and quasi-Newton solution methods, as well as the roles of optimality and duality will be discussed. Several talks will mention recent application areas which have motivated the development of new solution techniques. There will be a brief presentation on the outlook for funding by AFOSR for research on numerical methods in optimal control and optimization.

CHAIRMAN AND ORGANIZER
Caulton L. Irwin
Department of Mathematics
West Virginia University
Morgantown, WV

**An Inverse Transmission Problem for the Helmholtz Equation**
T. S. Angell and R. E. Kleinman
Department of Mathematical Sciences
University of Delaware
Newark, DE

G. F. Roach
Department of Mathematics
University of Strathclyde
Glasgow, Scotland

**Parameter Estimation in Elliptic Systems**
H. T. Banks
Division of Applied Mathematics
Brown University
Providence, RI

K. Kunisch
Institut fur Mathematik
Technische Universitat Graz
Graz, Austria, and Division of Applied Mathematics, Brown University
Providence, RI

**On Finite Elements Models for Control of Flexible Structures**
John A. Burns
Department of Mathematics
Virginia Polytechnic Institute and State University
Blacksburg, VA

E. M. Cliff
Department of Aerospace and Ocean Engineering
Virginia Polytechnic Institute and State University
Blacksburg, VA

**Fuel Optional Trajectories for Commercial Jet Aircraft**
James W. Burrows
Boeing Computer Services Company
Tukwila, WA

**Minimax, Constrained Optimization, Augmented Lagrangians, and Optimal Coatings**
William W. Hager and Rouben Rostamian
Department of Mathematics
The Pennsylvania State University
University Park, PA

Dwayne Presler
INTER-NATIONAL Research Institute
Newport News, VA

**AFOSR Funding for Control Theory and Optimization**
Marc Q. Jacobs
Department of Mathematics
University of Missouri, and
AFOSR-NM, Bowling AFB, DC

Tuesday, June 25*/10:30 AM*
Minisymposium 9*/Chatham A*
**MATHEMATICAL QUESTIONS IN ROBOTICS**
Mathematical problems relating to design, analysis and control issues for robot manipulators will be considered. Specific questions arising in this context include the design of optimal trajectories under geometric and dynamic constraints, analysis of kinematic capabilities, and the development of control methodologies for high performance robot operation.

CHAIRMAN AND ORGANIZER
Samuel P. Marin
Department of Mathematics
General Motors Research Laboratories
Warren, MI

**The Kinematics of Redundant Manipulators: A New Approach to the Inverse Problem**
John Baillieul
Department of Aerospace and Mechanical Engineering
Boston University
Boston, MA

**A New Approach to Robot Control**
Robert M. Goor
Department of Mathematics
General Motors Research Laboratories
Warren, MI

**Planning of Minimum Time Trajectories**
John Hollerbach
Artificial Intelligence Laboratory
Massachusetts Institute of Technology
Cambridge, MA

**Mathematical and Algorithmic Problems in Computer Vision**
Jacob T. Schwartz
Courant Institute of Mathematical Sciences
New York University
New York, NY

Tuesday, June 25*/10:30 AM*
Minisymposium 10*/Room 4*
**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS II**
The numerical solution of partial differential equations is of obvious importance. Solutions of partial differential equations exhibit a wide range of phenomena, and algorithms must be designed to adequately simulate such diversity. Thus, in general, algorithms are specialized to fit particular applications. Here, are discussed various theoretical and practical issues concerning such algorithms.

CHAIRMEN AND ORGANIZERS
James Boland and Janet Peterson
Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, PA

**The Relationship Between Truncation Error and the Actual Solution Error in Partial Differential Equations**
Andrew White
Los Alamos National Laboratory
Los Alamos, NM

**A Flux-Limited Diffusion Model for a Charge Particle Transport**
Milo R. Dorr
Lawrence Livermore National Laboratory
Livermore, CA

**Algorithms for Unusual Equations, e.g., The Onsager Equations**
Max D. Gunzburger
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

**Reduced Basis Methods for Partial Differential Equations**
(To be presented by the organizers)

Tuesday, June 25/*10:30 AM*
Minisymposium 11/*Room 5*
**GLOBAL METHODS FOR NONLINEAR SYSTEMS OF EQUATIONS**
Recent years have seen significant advances in the theory, algorithms, and computer implementations of globally convergent homotopy methods. Some engineering applications are particularly impressive, as is the wide range of applicability. These talks will cover the full spectrum of theory, algorithms, and applications.

CHAIRMEN AND ORGANIZERS
Layne T. Watson
Department of Computer Science
Virginia Polytechnic Institute and State University
Blacksburg, VA

Alexander P. Morgan
Department of Mathematics
General Motors Research Laboratories
Warren, MI

**A Homotopy Approach to Large Network Equilibrium Problems**
R. Saigal
Department of Industrial Engineering and Management Science
Northwestern University
Evanston, IL

**An Application of Projective Geometry to the Approximation of Solutions of Polynomial Equations**
R. Miranda and E. Allgower
Department of Mathematics
Colorado State University
Fort Collins, CO

**Application of Homotopy Methods to Optimal Pole Placement**
S. Richter
ITT Avionics
Clifton, NJ

**Piecewise Linear Approximation of Multidimensional Implicitly Defined Manifolds**
P. Schmidt
Department of Mathematical Sciences
University of Akron
Akron, OH

Tuesday, June 25/*10:30 AM*
Minisymposium 12/*Room 1*
**OPTIMIZATION OF LARGE ENGINEERING SYSTEMS**
Our main purpose is to present some recent advances in theoretical and numerical techniques of optimization that are applicable to computer assisted design of large or very complex mechanical or structural systems. The basic theme is the blending of theoretical development in applied mathematics and mechanics with numerical algorithms to facilitate improvements in design of large structures or mechanical systems. Only recently did the researchers in this field recognize some fundamental mathematical difficulties that arise in the numerical design optimization of such systems, particularly in the phenomena accompanying a loss of stability of the system or a loss of continuity in the design.

CHAIRMAN AND ORGANIZER
Vadim Komkov
Department of Mathematics
Winthrop College
Rockhill, SC

**Models for Plates with Rapidly Varying Thickness and their Relation to Optimal Design**
Michael Vogelius
Department of Mathematics
University of Maryland at College Park
College Park, MD

Robert V. Kohn
Courant Institute of Mathematical Sciences
New York University
New York, NY

**An Example of Three Dimensional Shape Optimization**
Jean Win Hou
Department of Mechanical Engineering and Mechanics
Old Dominion University
Norfolk, VA

**Optimal Shape Design of Arches**
Robert Benedict
Goodyear Tire Co.
Research Corporation
Talmadge, OH

**Design Optimization for Structural or Mechanical Systems Against the "Worst" Admissible Dynamical Loads**
Victor Dannon and Vadim Komkov
Department of Mathematics
Winthrop College
Rock Hill, SC

Tuesday, June 25/*3:30 PM*
Minisymposium 13/*Room 4*
**LATTICE ALGORITHMS AND THEIR APPLICATIONS**
(Sponsored by the SIAM Activity Group on Discrete Mathematics)
A lattice is the set of all integer linear combinations of a set of independent vectors (with rational coordinates)—called the basis of the lattice. The classical problem in geometry of numbers is concerned with finding bounds on the length of the shortest nonzero vector in the lattice and related problems. A related computational problem is: Given a basis, find a shortest nonzero element of the lattice. More generally, given a basis and any point in space, find a lattice element closest to the point. These computational problems have been tackled in recent years. A rich variety of applications have been found, for example in factoring polynomials over the rationals, integer programming and cryptography. This minisymposium will deal with the solution of some of the algorithmic questions on lattices and some applications.

CHAIRMEN AND ORGANIZERS
R. Kannan
Department of Computer Science
Carnegie-Mellon University
Pittsburgh, PA

Nimrod Megiddo
IBM Research Laboratory
San Jose, CA

**Recent Results and Problems on Bases of Lattices**
Laszlo Lovasz
Eotvos Lorand University
Budapest, Hungary

**On Lovasz's Basis Reduction Algorithm and the Nearest Point Lattice Problem**
L. Babai
Department of Computer Science
University of Chicago
Chicago, IL, and Eotvos Lorand University,
Budapest, Hungary

**The Cryptographic Security of Truncated Linearly Related Variables**
J. Hastead
Massachusetts Institute of Technology
Cambridge, MA

**Lattices in Integer Programming and Related Areas**
Ravi Kannan
Department of Computer Science
Carnegie-Mellon University
Pittsburgh, PA

Tuesday, June 25/*3:30 PM*
Minisymposium 14/*Room 1*
**GRADIENT AND FINITE ELEMENT TECHNIQUES IN OPTIMAL CONTROL II**

CHAIRMAN AND ORGANIZER
Caulton L. Irwin
Department of Mathematics
West Virginia University
Morgantown, WV

**Finite Element Approximation to Singular Problems in the Calculus of Variations, and Applications to Nonlinear Elasticity**
Greg Knowles
Department of Mathematics
Heriot-Watt University
Riccarton, Edinburgh, Scotland

**Theory and Applications of Duality Properties of Sequential Gradient—Restoration Algorithms for Optimal Control Problems**
A. Miele and T. Wang
Department of Mechanical Engineering
Rice University
Houston, TX

**A Review of Alternatives in Optimal Control Algorithms**
Elijah Polak and Theodore E. Baker
Department of Electrical Engineering and Computer Sciences and the Electronics Laboratory
University of California
Berkeley, CA

**Some Aspects of Quasi Newton Methods in Optimal Control**
Ekkehard W. Sachs
Department of Mathematics
North Carolina State University
Raleigh, NC

**Dynamics and Control of Large Space Structures**
V. B. Venkayya
AF Wright Aeronautical Laboratory
Wright Patterson AFB, OH

Wednesday, June 26/*10:30 AM and 3:00 PM*
Minisymposia 15 and 20/*Room 7*
**DEMONSTRATIONS OF LINEAR ALGEBRA SOFTWARE FOR MICROCOMPUTERS (2 parts)**
(Sponsored by the SIAM Activity Group on Linear Algebra)
This minisymposium, sponsored by the SIAM Activity Group on Linear Algebra, features live demonstrations of software for performing matrix computations on microcomputers. It will

provide a single location for microcomputer users to view the vast and diverse capabilities of such software and provide an introduction to this fast growing field. The focus of the demonstrations will be strictly on the technical capabilities of the software, such as the variety of matrix computations that can be performed, user interface, algorithms available, prerequisite hardware and software, graphics, and languages.

CHAIRMAN AND ORGANIZER
Robert C. Ward
Mathematical Sciences
Oak Ridge National Laboratory
Oak Ridge, TN

**The Scientific Desk**
E. L. Battiste
C. Abaci, Inc.
Raleigh, NC

**Linear Algebra in NAG Libraries for Microcomputers**
James C. T. Pool
Numerical Algorithms Group, Inc.
Downers Grove, IL

**PC-MATLAB**
Cleve Moler
The MathWorks, Inc.
Portland, OR

**Matrix Computations with IMSL MATH/LIBRARY**
John Brophy
Research and Design Department
IMSL, Inc.
Houston, TX

**Meeting the Demand: Software for Scientific Computations on Microcomputers**
Karen H. Haskell
Software Designs 2000
Albuquerque, NM

**Analysis of Scientific Data with Software Which Utilizes Matrix Manipulations**
Edwin E. Tucker
CET Research Group, Ltd.
Norman, OK

Wednesday, June 26/*10:30 AM*
Minisymposium 16/*Room 1*
**DIFFERENTIAL ALGEBRAIC EQUATION SYSTEMS**
Mathematical models for important physical phenomena such as the flow of an incompressible fluid or the plastic deformation of a thin sheet give rise to Differential Algebraic Equation Systems (DAES). In this minisymposium the speakers will address the analytical and algorithmic aspects of DAES. Case studies will also be discussed.

CHAIRMAN AND ORGANIZER
T. A. Porsching
Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, PA

**Numerical Solution of Differential/Algebraic Systems by Implicit Runge-Kutta Methods**
Linda R. Petzold
Applied Mathematics Division
Sandia National Laboratories
Livermore, CA

**Imbedding Methods for Differential Algebraic Equations**
Stephen L. Campbell
Department of Mathematics
North Carolina State University
Raleigh, NC

**DEM: A New Computational Approach to Sheet Metal Forming Problems**
C. A. Hall and W. C. Rheinboldt
Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, PA

J. C. Cavendish and M. L. Wenner
General Motors Research Laboratories
Warren, MI

**Some Differential-Algebraic Systems, Their Applications, and Solutions**
George D. Byrne and Peter R. Ponzi
Exxon Research and Engineering Co.
Annandale, NJ

Wednesday, June 26/*10:30 AM*
Minisymposium 17/*Chatham A*
**MATHEMATICAL MODELS IN ECOTOXICOLOGY**
(Sponsored by SIAM Institute for Mathematics and Society)
One of the most pressing scientific and political problems today is the maintenance of ecosystems under stresses created by man. A theory of chemical stress, associated toxicological effects, and risks for populations, communities, and ecosystems is emerging even though the complexity of the problems are enormous. Effects of chemicals range from physiological to biospherical levels; interactions between biological and chemical species with each other and with the physical environment are seldomly well-documented; and most work is site specific with information transference difficult. In spite of the inherent difficulties, mathematical modelling is beginning to play an organization role. Models are routinely being employed by governmental and industrial agencies as initial screening tests for new chemicals. This minisymposium will address the current developments and influences of mathematical modeling in recent studies of the fate and effects of chemicals in aquatic and terrestrial ecosystems as well as the associated risks of releasing a chemical into an environment.

CHAIRMAN AND ORGANIZER
Thomas G. Hallam
Department of Mathematics and Program in Ecology
University of Tennessee, Knoxville
Knoxville, TN

**The Analysis of Large Ecosystem Simulation Models: Problems and Solutions**
D. A. Weinstein
Ecosystems Research Center
Cornell University
Ithaca, NY

**On the Hypothetical Mode in Assessment**
W. S. Overton
Oregon State University
Corvallis, OR

**Environmental Exchange and Effects of Aquatic Toxicants**
Ray R. Lassiter
Athens Environmental Research Laboratory
U.S. Environmental Protection Agency
Athens, GA

**Population-Toxicant Interactions**
(To be presented by the chairman and organizer)

Wednesday, June 26/*10:30 AM*
Minisymposium 18/*Room 4*
**SUPERCOMPUTER — ALGORITHMS AND APPLICATIONS II**
(Sponsored by the SIAM Activity Group on Supercomputing)

CHAIRMAN AND ORGANIZER
Jack J. Dongarra
Mathematics and Computer Science Division
Argonne National Laboratory
Argonne, IL

**Algorithms for Sparse Matrices on Supercomputers**
Iain Duff
Mathematics and Computer Science Division
Argonne National Laboratory
Argonne, IL

**The Evolution of the Software/Hardware Boundary**
Kenneth W. Neves
Computational Mathematics
Boeing Computer Services Co.
Tukwila, WA

**Parallel Linear System Solvers**
Ahmed Sameh
Department of Computer Science
University of Illinois
Urbana, IL

Jack J. Dongarra and Danny Sorensen
Mathematics and Computer Science Division
Argonne National Laboratory
Argonne, IL

**Implementation of Some Sparse Matrix Computations on a Parallel Computer**
Danny C. Sorensen
Mathematics and Computer Science Division
Argonne National Laboratory
Argonne, IL

Wednesday, June 26/*3:00 PM*
Minisymposium 19/*Room 4*
**NUMERICAL APPROXIMATION**
When a problem is solved numerically, it is important to know exactly how good the solution is. Several "best" results from approximation theory will be discussed.

CHAIRMEN AND ORGANIZERS
M. J. Marsden and A. R. Reddy
Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, PA

**The Sharpness of Timans Theorem on Differentiable Functions**
Maurice Hasson
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

**Convergence of Derivatives of Interpolation**
Peter Hoffman
Department of Mathematics
Carnegie-Mellon University
Pittsburgh, PA

**Voronovksaya Theorems for Splines**
Martin J. Marsden
Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, PA

**Complex Approximation**
Thomas Metzger
Department of Mathematics and Statistics
University of Pittsburgh
Pittsburgh, PA

**Approximation on the Union of Disjoint Intervals**
A. R. Reddy
Department of Mathematics
University of Pittsburgh
Pittsburgh, PA

# CONTRIBUTED PAPERS

Monday, June 24/*10:30 AM*
Contributed Papers 1/*Room 6*

**ORDINARY DIFFERENTIAL AND INTEGRAL EQUATIONS**
CHAIRMAN: B. Ermentrout, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA

**Nonlinear Oscillations with Multiple Forcing Terms**
George C. Atallah and James F. Geer, Watson School of Engineering, Applied Science and Technology, SUNY-Binghamton, Binghamton, NY

**Secondary Bifurcation and Imperfection Sensitivity of Columns on Nonlinear Foundation**
John C. Amazigo and Moses O. Oyesanya, Department of Mathematics, University of Nigeria, Nsukka, Nigeria

**The Existence and Computation of Homoclinic Orbits for Autonomous Systems in the Plane**
Joseph R. Gruendler, Mathematical Analysis Division, National Bureau of Standards, Gaithersburg, MD

**A Quasi-Linearization Method for Parameter Estimation in Functional Differential Equations**
Dennis W. Brewer, ICASE, NASA Langley Research Center, Hampton, VA and Department of Mathematical Sciences, University of Arkansas, Fayetteville, AR

**Series Solution of Nonlinear Evolution Equations Using Continuous Transformation Groups**
Joseph S. Torok and Sunder H. Advani, Department of Engineering Mechanics, The Ohio State University, Columbus, OH

**Approximate Solutions for Nonlinear Reaction — Diffusion from Maximum Principles**
Monica Regalbuto, William Strieder and Arvind Varma, Department of Chemical Engineering, University of Notre Dame, Notre Dame, IN

**A Molecular Model for Sensing with Exact Adaptation**
Lee A. Segel, Department of Applied Mathematics, The Weizmann Institute of Science, Rehovot, Israel

**McKean's Caricature for Nerve Conduction**
Henry P. McKean Jr., Courant Institute of Mathematical Sciences, New York, NY; Victor H. Moll, Department of Mathematics, Temple University, Philadelphia, PA

**Multiple Scale Analysis of a Voltera-type Equation Arising in Particle Deposition Problems**
Michael H. Peters, Department of Chemical Engineering and Environmental Engineering, Rensselaer Polytechnic Institute, Troy, NY

Monday, June 24/*10:30 AM*
Contributed Papers 2/*Chatham A*
**CONTROL THEORY**
CHAIRMAN: J. Leightbourne, Department of Mathematics, West Virginia University, Morgantown, WV

**A Class of Oscillatory Devices for Adaptive Control Systems**
Y. A. Saet and G. L. Viviani, College of Engineering, Lamar University, Beaumont, TX

**Digital Relay-Controlled Model Reference Adaptive System**
S. J. Fu and M. E. Sawan, Department of Electrical Engineering, Wichita State University, Wichita, KS

**On the Pole Placement of Linear Systems**
S. J. Fu and M. E. Sawan, Department of Electrical Engineering, Wichita State University, Wichita, KS

**Qualitative Problems in Robot Dynamics**
Charles P. Neuman, Department of Electrical and Computer Engineering, Carnegie-Mellon University, Pittsburgh, PA

**Construction of a Priori Knowledge — Based Explicit Solution for a Set of Nonlinear Algebraic Equations**
Ali Abur and Ali Keyhani, Department of Electrical Engineering, Ohio State University, Columbus, OH

**A Numerical Method for Feedback Control of a Damped Euler-Bernoulli Beam Equation: Legendretau Approximation**
H. T. Banks and K. Ito, Lefschetz Center for Dynamical Systems, Division of Applied Mathematics, Brown University, Providence, RI

**Output Least Square Stability for Parameter Identification Problems**
Fritz Colonius, Universitat Bremen, West Germany; Karl Kunisch, Technische Universitat Graz, Austria, (both visiting at Lefschetz Center for Dynamical Systems, Division of Applied Mathematics, Brown University, Providence, RI

**Trajectory Calculation for Serial Robot Arm Motion**
Yu Kuang Chen, Mactronix R&D Department, Dallas, TX

**Estimation of Discontinuous Parameters in Partial Differential Equations**
Patricia K. Lamm, Department of Mathematics, Southern Methodist University, Dallas, TX

Monday, June 24/*3:15 PM*
Contributed Papers 3/*Room 5*

**FLUID DYNAMICS**
CHAIRMAN: I. Alexander, Department of Mathematics and Physics, Carnegie-Mellon University, Pittsburgh, PA

**Pattern Generation in the Normal Field Instability of Ferrofluids**
A. G. Boudouvis and L. E. Scriven, Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, MN

**On the Initial Formation of Shocks**
Richard Haberman, Department of Mathematics, Southern Methodist University, Dallas, TX

**Application of Finite Element Method in Extra-thin Lubrication Fluid Dynamic Problems**
Chih Wu, Department of Mechanical Engineering, U.S. Naval Academy, Annapolis, MD

**Singularity Formation and Roll-up in a Vortex Sheet**
Robert Krasny, Courant Institute, New York, NY

**Filtration Flows**
Donald A. Drew, Department of Mathematical Sciences and Mohamed Bentrcia, Department of Mechanical Engineering; Rensselaer Polytechnic Institute, Troy, NY

**An Exact Solution of the Navier-Stokes Equation Which Describes Stagnation Point Flow Impinging on a Flat Wall at an Arbitrary Angle of Incidence**
J. Mark Dorrepaal, Department of Mathematics, Old Dominion University, Norfolk, VA

**Weak Solutions of the Rectilinear Shear Flow Equation for Incompressible Elastic Liquids**
Hans Engler, Department of Mathematics, Georgetown University, Washington, DC

**A Justification of the Model of Missible Fluids Flow Through Porous Medium**
Andro Mikelic, Ruder Boskovic Institute, Zagreb, Yugoslavia; Ibrahim Aganovic, Department of Mathematics, University of Zagreb, Zagreb, Yugoslavia

Monday, June 24/*3:15 PM*
Contributed Papers 4/*Room 3*

**LINEAR AND NONLINEAR EQUATIONS**
CHAIRMAN: S. Rankin, Department of Mathematics, West Virginia University, Morgantown, WV

**Computation of the Index and Drazin Inverse of a Square Matrix by a Shuffle Algorithm**
Kurt Anstreicher, Yale S.O.M., New Haven, CT and Uriel G. Rothblum, Faculty of Industrial Engineering & Management, Technion — Israel Institute of Technology, Haifa, Israel

**Matrix Computations on the FPS-164/MAX Scientific Computer**
Steve Oslon, Floating Point Systems, Inc., Beaverton, OR

**A Downweighting Method for the Solution of Sparse Equality Constrained Least Squares Problems**
Jesse L. Barlow, Department of Computer Science, The Pennsylvania State University, University Park, PA

**Generalized Eigenvalue Approximation for Band Matrices**
William F. Moss, Department of Mathematical Sciences, Clemson University, Clemson, SC; Philip W. Smith, Department of Mathematical Sciences, Old Dominion University, Norfolk, VA

**Solutions of Nonlinear Algebraic Riccati Matrix Equations Arising in Discretized Linear Dynamical Systems**
John Jones, Jr., Chiewcharn Narathong, and A. D. Holten, Air Force Institute of Technology, School of Engineering, Dayton, OH

**Shamanskii Methods for Singular Problems**
C. T. Kelley, Department of Mathematics, North Carolina State University, Raleigh, NC

**Monotone Convergence of the Newton Iterates in the Numerical Solution of Nonlinear Two Point Boundary Value Problems**
Florian A. Potra, Department of Mathematics, University of Iowa, Iowa City, IA

**Generalized Polynomial Transformation**
Tom Hartley and Rick Ellison, Department of Electrical Engineering, The University of Akron, Akron, OH

**A New Scale-Invariant Homotopy**
Thomas L. Wayburn, Department of Chemical Engineering, Clarkson University, Potsdam, NY

Monday, June 24/*3:15 PM*
Contributed Papers 5/*Room 6*

**NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS**
CHAIRMAN: E. Overman, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA

**On Numerical and Analytical Study of Wall Boundary Conditions for Shock Reflection**
Charlie Harrison Cooke, Department of Mathematics, Old Dominion University, Norfolk, VA

**Boundary Conditions at Outflow for Problems with Transport and Diffusion**
Thomas M. Hagstrom, Department of Applied Mathematics and Statistics, SUNY at Stony Brook, Stony Brook, NY

**Computational Boundary Conditions for the Incompressible Navier-Stokes Equations**
Gerardo A. Ache and John C. Strikwerda, Department of Computer Science, University of Wisconsin, Madison, WI

**Difference Approximations to Variable-Angle Absorbing Boundary Conditions for the Multi-dimensional Wave Equation**
Robert L. Higdon, Department of Mathematics, Oregon State University, Corvallis, OR

**A Fourth Order Accurate Fast Direct Solver for the Helmholtz Equation in Three Dimensions**
Ronald F. Boisvert, Center for Applied Mathematics, National Bureau of Standards, Gaithersburg, MD

**Multigrid Tau Extrapolation for Neumann Boundary Conditions**
John H. Bolstad, Lawrence Livermore National Laboratory, Livermore, CA

**The Solution of A Coupled System of Ordinary and Partial Differential Equations Using an Abstract Cauchy Problem Setting**
Dennis W. Quinn, Department of Mathematics, Air Force Institute of Technology, Wright-Patterson AFB, OH

**Control Region Approximation**
B. J. McCartin and R. E. LaBarre, United Technologies Research Center, East Hartford, CT

**Walsh Series: Differentiation and Solution of Differential Equations**
William F. Blyth, Department of Mathematics, Royal Melbourne Institute of Technology, Melbourne, Australia

**On the Accuracy of Least Squares Methods in the Presence of Corner Singularities**
Christopher L. Cox, Department of Mathematical Sciences, Clemson University, Clemson, SC; George J. Fix, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA

Tuesday, June 25/*3:30 PM*
Contributed Papers 6/*Room 5*

**COMPUTATIONAL FLUID DYNAMICS**
CHAIRMAN: M. Sussman, Bettis Atomic Power Laboratory, Westinghouse Corporation, West Mifflin, PA

**Pattern Formation Near the Onset of Rayleigh-Benard Convection**
P. E. Bjorstad, Veritas Research, Hovik, Norway; W. M. Coughran, Jr., AT&T Bell Labortories, Murray Hill, NJ; H. S. Greenside, Princeton Plasma Physics Laboratory, Princeton, NJ

**Flow in a Channel of Varying Width**
N. S. Asaithambi and John C. Strikwerda, Department of Computer Science, University of Wisconsin, Madison, WI

**A Numerical Method for Computing the Flow in Spinning and Coning Fluid-filled Cyclinders**
Yvonne Nagel, Mathematics Research Center; John C. Strikwerda, Department of Computer Sciences and Mathematics Research Center, University of Wisconsin, Madison, WI

**New Developments in Particle-In-Cell Methods**
J. U. Brackbill, X-DO, and G. S. Fraley, X-1, Los Alamos National Laboratory, Los Alamos, NM

**Solution of Incompressible Navier-Stokes Equations by Projected Biconjugate Gradients**
Shenaz Choudhury, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA

**Extension of the CSCM-S Upwind Implicit Method to the Equations of Nonequilibrium Reacting Shocked Gas Flow**
C. K. Lombard, PEDA Corporation, Palo Alto, CA

**Efficient, Vectorizable Upwind Implicit Relaxation Algorithm for Three-Dimensional Gasdynamics**
C. K. Lombard, Farhad Raiszadeh and Jorge Bardina, PEDA Corporation, Palo Alto, CA

**An Adaptive Grid Algorithm for Hydrocode Simulations**
Joseph F. McGrath, KMS Fusion Inc., Ann Arbor, MI; Darrell L. Hicks, Mathematical and Computer Sciences Department, Michigan Technological University, Houghton, MI

Tuesday, June 25/*3:30 PM*
Contributed Papers 7/*Chatham A*

**OPTIMIZATION ROBOTICS**
CHAIRMAN: I. Abu-Hsumays, Bettis Atomic Power Laboratory, Westinghouse Corporation, West Mifflin, PA

**Isotone Tangent Cones and Nonsmooth Optimization**
Douglas E. Ward, Department of Mathematics and Statistics, Miami University, Oxford, OH

**Applications of Z-Transforms to Financial Analysis**
David J. Eaton, Systems Operations Division, Optical Group, Perkin-Elmer Corporation, Danbury, CT

**An Optimal Design Problem for Submerged Bodies**
T. S. Angell, G. C. Hsiao and R. E. Kleinman, Department of Mathematical Sciences, University of Delaware, Newark, DE

**Generalized Simulated Annealing for Function Optimization**
Ihor O. Bohachevsky, Mark E. Johnson, and Myron L. Stein, Los Alamos National Laboratory, Los Alamos, NM

**Numerical Methods for Nonlinear Variational Problems**
Alexander Eydeland, Mathematics Research Center, University of Wisconsin, Madison, WI and Mathematics and Statistics Department, University of Massachusetts, Amherst, MA

**Structural Optimization in Chinese Railway**
Yu Weiren, Dalian Railway Institute, Dalian China; and Visiting Scholar of University of Maryland, College Park, MD

**Determination of the Inverse Kinematic Solution for a Robot Manipulator using CMAC**
Saleem Karimjee and B. W. Mooring, Department of Mechanical Engineering, Texas A&M University, College Station, TX

**Modelling of Collision Avoidance for Multiple Robots in Cooperation**
Lung Yu Shih, Division of Electrical Engineering, National Research Council, Ottawa, Canada

Wednesday, June 26/*10:30 AM*
Contributed Papers 8/*Room 3*

**NUMERICAL ORDINARY DIFFERENTIAL AND INTEGRAL EQUATIONS**
CHAIRMAN: C. Cullen, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA

**Evaluation of EXPIRK: A Stiff ODE Solver**
Hans Hamilton, Department of Mathematics, North Carolina State University, Raleigh, NC; David Voss, Department of Mathematics, Western Illinois University, Macomb, IL

**Interpolation for Runge-Kutta Methods**
Lawrence F. Shampine, Numerical Mathematics Division 1642, Sandia National Laboratories, Albuquerque, NM

**Uniform High-Order Finite-Difference Schemes for a Scalar, Linear, Singularly Perturbed Two-Point Boundary Value Problem**
Eugene C. Gartland, Jr., Department of Mathematics, Southern Methodist University, Dallas, TX

**Numerical Methods for Highly Oscillatory Ordinary Differential Equations with Harmonic Structure**
Robert E. Scheid, Jr., Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA; Heinz-Otto Kreiss, Applied Mathematics, California Institute of Technology, Pasadena, CA

**Numerical Methods for Higher Order ODEs and Matrix Splitting**
Jesse Barlow and Suchitra Gupta, Department of Computer Science, The Pennsylvania State University, University Park, PA

**New Methods for Calculating the Stability of Periodic Solutions**
R. Seydel, Department of Mathematics, State University of New York at Buffalo, Buffalo, NY

**Automatic Solution of Nonlinear Integral Equations**
H. H. Kagiwada and R. Kalaba, Electro-Optical and Data Systems Group, Hughes Aircraft Company, El Segundo, CA; K. Spingarn, Space and Communications Group, Hughes Aircraft Company, Los Angeles, CA

**The Numerical Solution of a Class of Nonlinear Delay-differential Equation of Mixed Type**
Henjin Chi, Jonathan Bell and Brian Hassard, Department of Mathematics, SUNY at Buffalo, Buffalo, NY

Wednesday, June 26/*10:30 AM*
Contributed Papers 9/*Room 5*

**PARTIAL DIFFERENTIAL EQUATIONS**
CHAIRMAN: J. Schaeffer, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA

**Some Nonoscillation Comparison Theorems for Strongly Elliptic PDE's**
J. L. Moseley, Department of Mathematics, West Virginia University, Morgantown, WV

**Some Nonlinear Conservation Laws**
Kenneth L. Kuttler and Darrell L. Hicks, Department of Mathematical and Computer Sciences, Michigan Technological University, Houghton, MI

**On the Weak Cauchy Problem in the Large for Semilinear Degenerate Parabolic Equations**
Guillermo S. Ferreyra, Department of Mathematics, Louisiana State University, Baton Rouge, LA

# Contributed Papers

**A Class of Degenerate Elliptic Equations of the Fourth Order**
Richard Jay Weinacht, Department of Mathematical Sciences, University of Delaware, Newark, DE

**On the Correspondence of Kinematic Waves to Anisotropic Wave Propagation**
Martin B. Lesser, Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Philadelphia, PA

**Increasing Diffusion Coefficients and Sorption Limits**
Pat Hagan, Exxon Corporate Science Laboratories, Annandale, NJ

**$L^\infty$ Estimates and Weak Solutions for Materials Undergoing Phase Transitions**
Victor Roytburd and Marshall Slemrod, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, NY

**Electromagnetic Resonances For a Slender Body of Revolution: Low Order Axisymmetric Modes**
James Geer, Watson School of Engineering, Applied Science and Technology, SUNY-Binghamton, Binghamton, NY; Richard Barshinger, Department of Mathematics, Penn State University-Scranton Campus, Dunmore, PA

Wednesday, June 26/*10:30 AM*
Contributed Papers 10/*Room 6*

**FINITE ELEMENT METHODS**
CHAIRMAN: Janet Peterson, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA

**Adaptive Finite-Element Methods in Two Dimensional, Triangularized Regions**
Maria-Cecilia Rivara, Department of Mathematics and Computer Science, University of Chile, Santiago, Chile

**Finite Element Technique for Optimal Pressure Recovery from Stream Function Formulation of Viscous Flows**
M. E. Cayco and R. A. Nicolaides, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA

**The Treatment of Inhomogeneous Dirichlet Boundary Conditions by the p-Version of the Finite Element Method**
Ivo Babuska, Institute for Physical Science and Technology, University of Maryland, College Park, MD; Manil Suri, Department of Mathematics and Computer Science, University of Maryland Baltimore County, Catonsville, MD

**Finite Element Approximation of the Zero Equation Model of Turbulence**
James C. Turner, Jr., Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA

**Finite Element Methods for First Order Elliptic Systems**
Chinglung Chang, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA

**Least Squares Methods for Compressible Flow Problems**
Tsu-Fen Chen, Department of Mathematics, Iowa State University, Ames, IA; George J. Fix, Department of Mathematics, Carnegie-Mellon University, Pittsburgh, PA

**Solution of Nonlinear Reaction-Diffusion Equations with Discontinuous Boundary Conditions by Finite Element Methods**
Patrick L. Mills, Chemical Reaction Systems Group, Monsanto Company, St. Louis, MO: Steven Lai and Milorad P. Dudukovic, Department of Chemical Engineering, Washington University, St. Louis, MO

**Finite Element Modelling of Multi-Purpose Membranes**
Peter Nwoye O. Mbaeyi, Division of Theoretical Chemistry, University of Tuebingen, West Germany

**Automatic Interactive Boundary for Finite-Element Meshes**
Thomas R. Canfield and Mark P. Sears, Sandia National Laboratories, Computational Physics and Mechanics Division I, Albuquerque, NM

Wednesday, June 26/*3:00 PM*
Contributed Papers 11/*Room 1*

**ELASTICITY**
CHAIRMAN: C. Caldwell, Bettis Atomic Power Laboratory, Westinghouse Corporation, West Mifflin, PA

**Stress Singularities at Angular Corners of Composite Plates**
Xing-ren Ying and I. Norman Katz, Washington University, St. Louis, MO

**Application of Complex Variable Theory for Stress Analysis of Notched, Anisotropic Materials**
Terry D. Gerhardt, Engineering Design Criteria, Forest Products Laboratory, Madison, WI

**Oblique Impact of a Plate on a Rigid Wall**
Aaron D. Gupta, U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD

**Influence of Effective Rate Sensitivity on Adiabatic Shear Instability**
T. J. Burns, Sandia National Laboratories, Thermomechanical and Physical Division, 1534, Albuquerque, NM

**Forced Bending Vibrations of Stretched Plates**
Bulent A. Ovunc, Department of Civil Engineering, University of Southwestern Louisiana, Lafayette, LA

**Minimization and Robustness in the Homogeneous Dead-Load Traction Problem for Incompressible, Isotropic Finite Elasticity**
Gearoid P. Mac Sithigh, Department of Engineering Mechanics, University of Missouri, Rolla, MO

**Asymptotic Behavior of a Thermoviscoplastic Material Under Cyclic Loading**
Michael S. Pilant, Department of Mathematics, Texas A & M University, College Station, TX

Wednesday, June 26/*3:00 PM*
Contributed Papers 12/*Room 5*

**COMBINATORICS/STOCHASTICS**
CHAIRMAN: J. Fink, Department of Mathematics and Statistics, University of Pittsburgh, Pittsburgh, PA

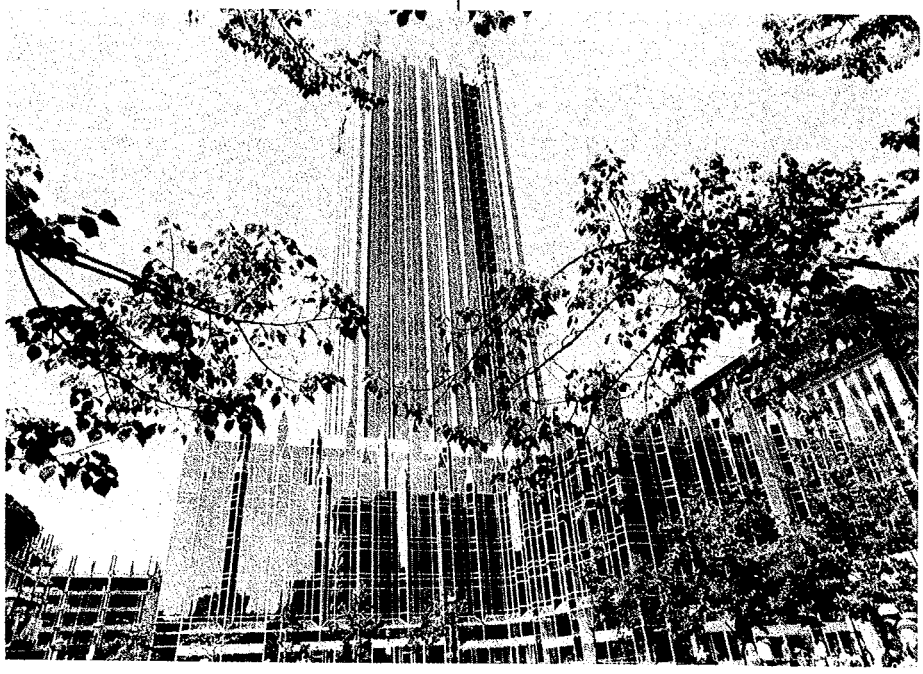
**Maximum Length Shift Register Sequences**
Xiu-ding Lin, Department of Mathematics, North Carolina State University, Raleigh, NC and Mathematics Department, China University of Science and Technology, Hofei, Anhuw, China

**A Stochastic Approach to the Problem of Filtering Measured Kinematic Gait Data**
B. A. Ardekani and A. Keyhani, Department of Electrical Engineering; M. Fatehi and M. Balmaseda, Department of Physical Medicine, The Ohio State University, Columbus, OH

**Effective Equation and Renormalization for a Random Nonlinear Wave Problem**
Luis L. Bonilla, Department of Mathematics, Stanford University, Stanford, CA

**Applications of Martingale Representations to the Optimal Routing/Flow Control of Packet Radio Networks**
William S. Hortos, Jr., Systems Analysis Group, Lockheed Electronics Company, Orlando, FL

**Regression When the Distribution Function of Errors is a Random Variable**
David M. Levy, Center for Public Choice, George Mason University, Fairfax, VA



Wednesday, June 26/*3:00 PM*
Contributed Papers 13/*Room 6*

**NUMERICAL AND ASYMPTOTIC METHODS**
CHAIRMAN: J. Moseley, Department of Mathematics, West Virginia University, Morgantown, WV

**How to Program a Loosely-Coupled Multiprocessor for Scientific Computing Applications**
William Gropp, Research for Scientific Computation, Yale University, New Haven, CT

**IST Numerical Schemes for Nonlinear Evolution Equations of Physical Interest**
Thiab R. Taha, Computer Science Department, The University of Georgia, Athens, GA; Mark J. Ablowitz, Mathematics and Computer Science Department, Clarkson University, Potsdam, NY

**Non-obtuse Triangulation of a Polygon**
Brenda S. Baker and Eric Grosse, AT&T Bell Laboratories, Murray Hill, NJ; Conor S. Rafferty, Stanford University, Stanford, CA

**Applications of Data Base Algorithms in Computational Physics**
Francis Sullivan, Center for Applied Mathematics, National Bureau of Standards, Gaithersburg, MD

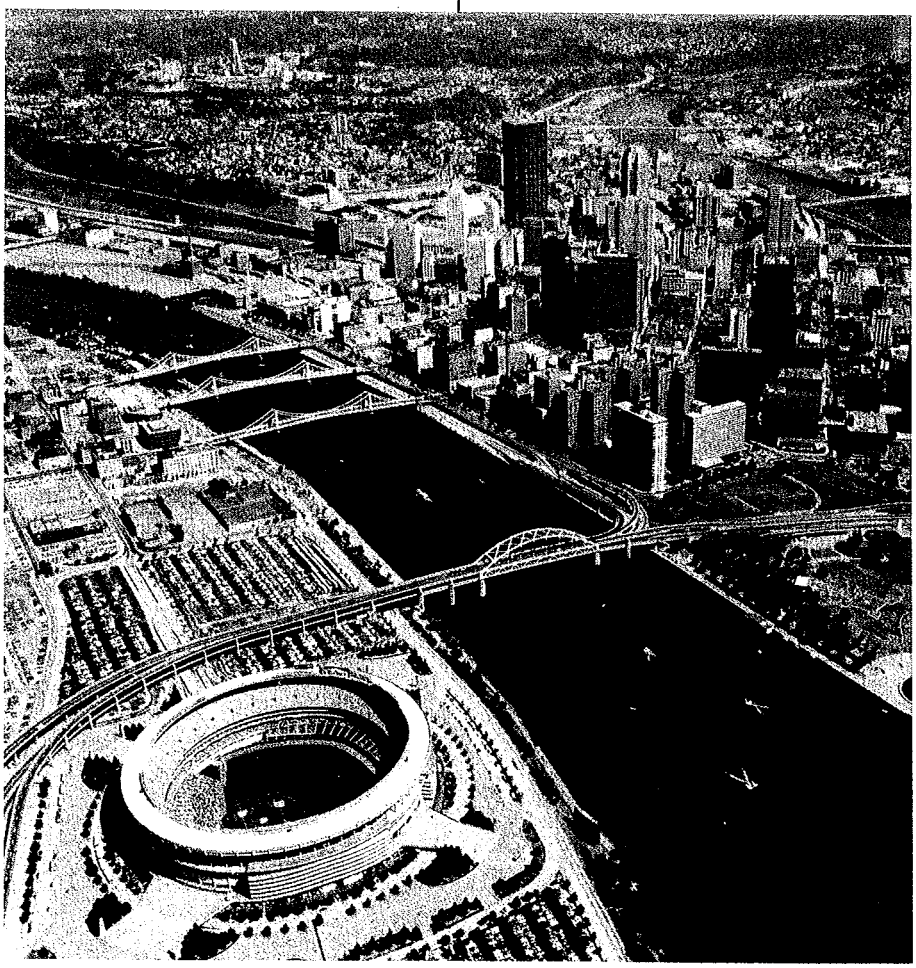
**A New Method for Model Reductions**
Fang-Bo Yeh, Department of Mathematics, Tunghai University, Taichung, Taiwan

**Scientific Computation for Optimal Feedback Control of Continuous Time Markov Dynamical Systems**
Floyd B. Hanson, Department of Mathematics, Statistics, and Computer Science, University of Illinois at Chicago, Chicago, IL

**Numerical and Analytic Studies of the Distributional Multipole Identity III**
Ira L. Karp, LORAL Electronic Systems, Advanced Systems Department, Yonkers, NY; Anthony S. Cantone, Harris Corporation, Melbourne, FL

**Asymptotic Evaluation of Some Hankel Transforms**
C. L. Frenzen, Department of Mathematics, Southern Methodist University, Dallas, TX; R. Wong, Department of Mathematics and Astronomy, University of Manitoba, Winnipeg, Manitoba, Canada

**A Unified Study of Fourier Domain Variational Methods for MIC Transmission Line Applications**
Bing H. Liu, Department of Electrical and Electronics Engineering, North Dakota State University, Fargo, ND



# POSTER PRESENTATIONS

Tuesday, June 25/*3:30 PM*
**Poster Session 1**/*Room 6*

**The Electrostatic Potential Field for a Slender Axially Symmetric Dielectric Body**
Richard N. Barshinger, Department of Mathematics, Penn State University-Scranton Campus, Dunmore, PA; James F. Geer Department of Systems Science, Watson School of Engineering, SUNY at Binghamton, Binghamton, NY

**Singularities, Configurations and Displacement Functions for Manipulators and Linkages**
Faydor L. Litvin, Mechanical Engineering Department and Robotics and Automation Laboratory, University of Illinois at Chicago, Chicago, IL

**Applications of Optimization Techniques to Minimize the Spacecraft Fuel Consumption in Deep Space Navigation**
Tseng-Chan Wang, Richard F. Sunseri and Richard H. Stanford, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

**A New Methodology for Complex Problems**
G. Adomian, Center for Applied Mathematics, University of Georgia, Athens, GA

**Failures of Local Approximation in Finite-Element Methods for Diffusion**
Douglas A. Kurtze, Department of Physics, Clarkson University, Potsdam, NY

**Electromagnetic Resonances for a Slender Body of Revolution: Higher Order Axisymmetric Modes. Progress Report**
Richard N. Barshinger, Department of Mathematics, Penn State University-Scranton Campus, Dunmore, PA; James F. Geer, Department of Systems Science, Watson School of Engineering, SUNY at Binghamton, Binghamton, NY

**Solution of the Radiation Transport Equation by the Finite Element Method**
Aleksei I. Shestakov, Computational Physics Division, Lawrence Livermore National Laboratory, Livermore, CA

**Nonlinear Waves In Dispersed Two-Phase Flows**
Ian Christie and Gary Ganser, Department of Mathematics, West Virginia University, Morgantown, WV; D. A. Drew, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, NY

# TRANSPORTATION INFORMATION

## By Air

PARKWAY TRAVEL has been selected to be the official agent for the conference and will guarantee the lowest rates available to Pittsburgh. *Call their number toll free:* 1-800-235-6500. Calling hours are 8:30 am to 5:30 pm (Eastern Standard Time) Monday through Friday and 10:00 am to 2:00 pm (Eastern Standard Time) on Saturday. BE CERTAIN TO MENTION THAT YOU ARE ATTENDING THE SIAM MEETING IN PITTSBURGH. They will mail you tickets or arrange for them to be waiting for you at the airport of your choice.

**Special Discount:** US Air has been chosen as the official carrier for the meeting and they have agreed (through Parkway Travel) to waive all restrictions for our group, thereby giving you the lowest fare possible. These fares will not be available through any agency other than PARKWAY TRAVEL. In any event, Parkway Travel will guarantee you the best available fare no matter which carrier you choose.

In order to get the flight of your choice, we suggest making reservations as soon as possible.

## From the Airport

| | |
|---|---|
| **Airport Bus (Green lettering)** | **$ 6.00** |
| **Taxi** | **$20.00** |

**By Car**

Turn right from the airport and go east on the Airport Parkway West. Take the Fort Pitt tunnel to the Fort Pitt Bridge. Over the bridge, go straight onto Liberty Avenue. Proceed to Sixth Avenue and turn right. The hotel will be at the top of the hill on the left.

## By Car

From the Turnpike, New York and Buffalo

**Pennsylvania Turnpike**
Get off at Pittsburgh Exit #6. From the Turnpike take Route 376, which takes you into the city. Come in as far as you can. You will see detour signs, follow them.

**New York City**
Coming from the Turnpike, take Route 376, which takes you into Pittsburgh. Come in as far as you can, until you see detour signs, which you should follow.

**Upper New York (Buffalo)**
Coming from Exit 79, come to Junction 279 into Pittsburgh. Go through the Fort Pitt Tunnel onto the Fort Pitt Bridge. Cross Fort Pitt Bridge straight to Liberty Avenue and follow to 6th Avenue. Turn right on 6th Avenue, stay on the avenue until you see the Hyatt sign on the top of the building and drive right up to it.

## Car Rental

National Car Rental is the official agency for the SIAM Spring Meeting. The specially discounted per day rates with unlimited mileage are $34.00 for Economy Cars, $35.00 for Compacts, $36.00 for Midsize, $37.00 for a two-door Fullsize and $38.00 for a four-door Fullsize. This discount does not apply for one-way rentals.

You should have an advance reservation to guarantee availability. **Call 1-800-328-7949.** Be certain to mention Recap # 6400705. Please identify yourself as an attendee at the SIAM Spring Meeting.

- Cars may be picked up and dropped off at the airport and downtown locations.
- Call early to guarantee availability.
- You must have one of the following credit cards to rent a car: AMEX, MC, VISA, DC.

# UPCOMING SIAM CONFERENCES

*July 15–19, 1985*
**SIAM Conference on Geometric Modeling and Robotics**
Hilton Hotel
Albany, New York

*October 28–30, 1985*
**SIAM Fall Meeting**
Arizona State University
Tempe, Arizona

*November 18–21, 1985*
**SIAM Conference on Parallel Processing**
Omni Hotel
Norfolk, Virginia

*May 14–16, 1986*
**Third SIAM Conference on Discrete Mathematics**
Clemson University
Clemson, South Carolina

*For additional information, contact SIAM Conference Coordinator, Suite 1400, 117 South 17th Street, Philadelphia, PA 19103-5052. Telephone: 215-564-2929*

# HOTEL INFORMATION

**Hyatt Pittsburgh at Chatham Center**
**112 Washington Place**
**Pittsburgh, PA 15219**
**(412) 471-1234**

SIAM is holding a block of rooms at the conference site, the Hyatt Pittsburgh at Chatham Center, on a first come, first served basis. Specially discounted room rates are $65.00 per single and $75.00 per double. These rooms will be held for our exclusive use only until June 2, 1985, after which availability cannot be guaranteed.

Your reservation is not confirmed until acknowledged in writing by the hotel or verified by phone.

We urge you to make your reservations promptly by telephoning the hotel at (412) 471-1234, or via the enclosed business reply card. When making reservations by telephone, be certain to obtain the discounted rate by identifying yourself as an attendee at the SIAM Spring Meeting.

# ON CAMPUS HOUSING

SIAM has reserved a block of dormitory rooms in Mudge House and Morewood Gardens at Carnegie-Mellon University. The dormitories are a 10 minute ride from the conference site and transportation will be provided to the conference site every morning and back to the dormitories after the program and special functions in the evening. The rooms are comfortable, although there are no telephones, televisions or air conditioning. Bathrooms are shared between two rooms.

You may check-in to your room until 10:30 pm on your stated day of arrival and you must check-out by 7:00 pm on your day of departure.

To access the dormitories from the airport, take the oakland limousine and get off at the University Inn and then take a cab, or, get off at Webster Hall near the CMU campus and walk ½ mile.

Registration and full payment must be received by June 11, 1985. There will be a 50% charge for no-shows, a 10% charge for cancellations within two weeks of arrival, and a full refund for cancellations two weeks or more prior to arrival. Checks only, no credit cards please. Confirmation letters and arrival instructions will be mailed to all registrants.

# REGISTRATION INFORMATI

The registration desk will be located in the Foyer on the Second Floor Ballroom and Meeting Room level of the Hyatt Pittsburgh at Chatham Center and will be open as listed below.

**Sunday, June 23** **5:00 pm–10:00 pm**
**Monday, June 24–Wednesday, June 26** **7:30 am–6:00 pm**

| | | SIAM Member | Non-Member | Full-Time Student |
|---|---|---|---|---|
| Registration Fees | Advance | $45 | $58 | $12 |
| | On Site | $58 | $78 | $12 |

# HOTEL RESERVATION REQUEST FORM

**Pittsburgh Hyatt At Chatham Center**

Specially discounted rooms will be held only until June 2, 1985. 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 SIAM Spring Meeting. Telephone: (412) 471-1234.

*PLEASE PRINT*

Name _____

Address _____

City _____ State _____ Zip _____ Phone _____

Please guarantee my room for late arrival* _____

VISA _____ AMEX _____ Diners Club _____ Mastercard _____

My credit card number is _____ Expiration Date _____

Please Reserve: Single ($65.00) _____ Double ($75.00) _____

Arrival Date _____ Arrival Time _____ Check Out Date _____

** If you list a credit card number, please enclose this card in an envelope and mail to:* Reservations, Hyatt Pittsburgh at Chatham Center, 112 Washington Place, Pittsburgh, PA 15219.

You may check into the hotel after 2:00 PM on your day of arrival and you must check out by 12:00 noon on your day of departure.

***Late Arrival Policy:***
If you plan to arrive after 6:00 PM, you must guarantee payment in advance by listing your AMEX, VISA, Diners Club or Mastercard number on the adjacent Hotel Reservations Request form.

***Cancellation Policy:***
If you need to change or cancel your reservation, be certain to contact the hotel by 4:00 PM Pittsburgh time on your stated day of arrival to avoid billing.

# DORMITORY REQUEST CARD

**Carnegie-Mellon University**
**SIAM Spring Meeting, June 24–26, 1985**

Name _____

Address _____

City _____ State _____ Zip _____ Phone _____

Single _____ Double _____ Gender(s)—please circle M F

Arrival date _____ Check-out date _____

| Rates: | Per day | Three day package |
|---|---|---|
| Single (per person) | $20.00 | $54.00 |
| Double (per person) | $18.00 | $45.00 |

Check enclosed for $_____. FULL ADVANCE PAYMENT REQUIRED.
*Mail to:* Housing Office, Carnegie-Mellon University, 1060 Morewood Avenue, Pittsburgh, PA 15213, Attention: SIAM Conference

| Rates (per person): | Per day | Three day package |
|---|---|---|
| Single | $20.00 | $54.00 |
| Double | $18.00 | $45.00 |

Breakfast, lunch and dinner are served nearby in Skibo Hall.

To reserve a room, fill out the Dormitory Request Card on the inside back cover of this program and mail to: Housing Office, Carnegie-Mellon University, 1060 Morewood Ave., Pittsburgh, PA 15213, attention: SIAM Conference.

**Information: 412-578-2139**

# ADVANCE REGISTRATION FORM

## SIAM Spring Meeting

**Pittsburgh Hyatt at Chatham Center**
**Advance registration must be received at the SIAM office by June 18, 1985.**

| | | SIAM Member | Non-Member | Full-Time Student |
|---|---|---|---|---|
| Registration Fees | Advance | $45 | $58 | $12 |
| | On Site | $58 | $78 | $12 |
| Registration amount enclosed | | $_____ | $_____ | $_____ |
| Wine and Cheese Party $10 Monday, June 24, 7:00 pm | | $_____ | $_____ | $_____ |
| Dinner Cruise $16 Tuesday, June 25, 6:30 pm | | $_____ | $_____ | $_____ |
| TOTAL amount enclosed | | $_____ | $_____ | $_____ |

Name _____ Department _____

Affiliation _____ Telephone _____

Address _____ City _____ State _____ Zip _____

Local Address in Pittsburgh _____

☐ **Please send me information about membership in SIAM.**

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

| Wine and Cheese Party | Dinner Cruise |
|---|---|
| Monday, June 24, 7:00 pm | Tuesday, June 25, 6:30 pm |
| $10.00 | $16.00 |

***Special Note:***
There will be no pro-rated fees. There will be no refunds after the conference starts.

***Telephone Messages:***
The telephone number at the Pittsburgh Hyatt is (412) 471-1234. The operator will transfer calls to our registration desk. Messages will be posted.