Institute for Mathematics and its Applications

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IMA UPDATE

Summer 1997

This is one of a series of quarterly notices concerning the activities of the Institute for Mathematics and its Applications.

CONTENTS

I. NEWS AND NOTES

a. Two-year Postdoc Opportunity

From the inception of the IMA, Postdoctoral Associates who were selected to participate in the annual programs have held one-year positions. Beginning Fall 1998, all postdocs at the IMA will hold **two-year positions.** That is, the postdocs who will be hired for the 1998–99 year on **Mathematics in Biology** will be hired for the period September, 1998 through August, 2000. During their second year, they will continue participating half-time in IMA activities and will also hold half-time teaching appointments at the University of Minnesota.

Applications will be due January 15, 1998. Only those receiving Ph. D. degrees between 1995 and 1998 will be eligible.

University of Chicago, University of Cincinnati, University of Houston, University of Illinois (Chicago), University of Illinois (Urbana), University of Iowa, University of Kentucky, University of Manitoba, University of Maryland, University of Michigan, University of Minnesota, University of Notre Dame, University of Pittsburgh, University of Southern California, University of Wisconsin, Wayne State University.

PARTICIPATING CORPORATIONS: Bellcore, Cray Research, Eastman Kodak, EPRI, Ford, Fujitsu, General Motors, Honeywell, IBM, Kao, Motorola, LORAL, Siemens, 3M.

b. Industrial Problems Seminar Videotape is now available

The IMA Industrial Problems Seminar is a well-received program in which the IMA invites industrial scientists who use mathematics to speak to IMA participants and university researchers. The problems presented are real industrial problems. Both Industry and Mathematics benefit: Industry, by the increase of mathematical knowledge and ideas brought to bear on their concerns, and Mathematics, through the infusion of exciting new problems. The seminar takes place at the IMA most Fridays at 11:15 am.

The first 20 minutes of each of three recent Industrial Problems Seminar talks were recorded and edited on videotape:

Gary Strumulo	Ford Motor Company	October 4, 1996
	"Discrete Fluids Using Lattice Gas Methods"	
David Ross	Eastman Kodak	November 1, 1996
	"Measuring Coalescence Rates"	
Blaise Morton	Honeywell	February 14, 1997
	"Modeling of Building Cooling Systems"	

The videotape (70 minutes) is available from the IMA at cost: $15.00 each. The video would be appropriate for faculty, graduate students and/or advanced undergraduates seeking a taste of industrial research. Write to the address above, or e-mail to `staff@ima.umn.edu`, to request a copy.

All Industrial Problems Seminar talks are discussed, along with open problems and partial solutions when available, in one of Avner Friedman's series of books, *Mathematics in Industrial Problems.* The first nine volumes in this series have already been published by Springer-Verlag as part of the *IMA Volumes in Mathematics and its Applications.* The three talks on the videotape are covered in volume 10, which will appear soon (ordering information appears below).

Two previous videotapes produced by the IMA are still available, in limited quantities, at the IMA cost of $10.00 each. These are: "Women in Mathematical Sciences Connected to Industry" (workshop held February 23–25, 1996); and "Minorities and Applied Mathematics: Connections to Industry" (workshop held October 4–6, 1996).

c. PI Conferences Selected for 1997–98

Seven IMA Participating Institution Conferences have been selected for funding during 1997–98:

DATES	LOCATION	TITLE
June 1-3, 1997	Indiana University	Nonlinear Problems in the Applied Sciences
July 30–August 3, 1997	Penn State University	Topics in Number Theory
December 14–16, 1997	Univ. of Southern California	Stochastic Control and Nonlinear Filtering
March 25–28, 1998	University of Cincinnati	Global Analysis 30 Years Later
Spring 1998, date TBA	Purdue University	Workshop on Superconductivity
June 3–6, 1998	Univ. of Wisconsin-Madison	7th Conference of the International Linear Algebra Society
September 26–28, 1998	University of Pittsburgh	Waves and Continuation Methods in Biology and Related Areas

Interested participants are urged to address their inquiries to the organizers at the Participating Institution where the conference will be held. Conference Participants from other Participating Institutions may use PI funds for their expenses, where these are available.

All faculty members of Participating Institutions of the IMA were encouraged to submit proposals for this annual competition. There is no restriction on the mathematical topic of the conferences, but they should be of interest to a number of Participating Institutions, and the organizing committee should contain some faculty members

from these institutions. The faculties of the Participating Institutions were consulted about the proposals, and the final decision was made by a panel of Participating Institution department heads. Proposals for 1998–99 will be due in April, 1998.

d. Participating Institution Conference: "Topics in Number Theory", July 30–August 3, 1997 at Penn State University

The Department of Mathematics and the Continuing and Distance Education Service at Penn State have organized "Topics in Number Theory", an international conference to be held July 30–August 3, 1997 at the University Park Campus. Many number theorists who have profoundly influenced current trends will be giving talks which will highlight the interplay between combinatorics, classical arithmetic geometry and number theory. In order to promote the sometimes surprising connections between combinatorics and number theory, the program has been planned to allow each conferee an opportunity to listen to talks in more than one of these areas.

In addition, some plenary lectures will be devoted to disseminating "state of the art" results to a broad audience of specialists, graduate and postdoctoral students, and mathematicians from business, government and industry.

For more information, please visit the conference web site: `http://www.cde.psu.edu/C&I/NumTheory/`

The IMA is also supporting the Workshop as follows. Mathematicians from the Participating Institutions of the IMA are eligible to receive IMA/PI funding, where available, to come to the Workshop. Application to use IMA/PI funds for the workshop should be made directly to the mathematician's own department chair.

e. Participating Institution Conference: Seventh Conference of the International Linear Algebra Society June 3–6, 1998 at the University of Wisconsin - Madison

PURPOSE OF THE CONFERENCE: To bring together researchers and educators in all aspects of pure and applied linear algebra and matrix theory in order to allow for a broad exchange of ideas and dissemination of recent developments and results. The conference will be dedicated to Hans Schneider in recognition of his enormous contributions to linear algebra and the linear algebra community.

THEMES: Algebraic, analytic and combinatorial matrix theory, numerical linear algebra, matrix perturbations, matrix stability and applications in engineering, linear algebra in control and systems theory, splines and linear algebra, applications of linear algebra to statistics, linear algebra education.

INVITED SPEAKERS: (hour speakers) R. Barmish, R. Bhatia, N. Higham, T. Laffey, V. Mehrmann, D. Hershkowitz, U. Rothblum, G. Harel; (half-hour speakers) F. Silva, J. McDonald, P. Lancaster, R. Loewy, C. de Boor.

MINISYMPOSIA: Topological methods in linear algebra (M. Goldberg), Linear algebra methods in statistics (H. J. Werner), Graph theory and linear algebra (R. Merris), Numerical linear algebra (M. Overton), Matrix inertia and stability (B. N. Datta), Educational issues in linear algebra (D. Carlson & F. Uhlig).

CONTRIBUTED PAPERS: On all aspects of linear algebra and matrix theory.

ORGANIZING COMMITTEE: R. A. Brualdi (chair), B. Cain, B. N. Datta, J. Dias da Silva, S. Friedland, M. Goldberg, U. Rothblum, J. Stuart, D. Szyld, R. Varga.

PROCEEDINGS: A special issue of the journal Linear Algebra and Its Applications, with special editors B. Cain, B. N. Datta, M. Goldberg, U. Rothblum, D. Szyld. The issue will be dedicated to Hans Schneider.

HOUSING: Either the Chadbourne Hall dormitory or a nearby Howard Johnson's Hotel.

BANQUET: A banquet is planned for Friday, June 5, 1998 in Great Hall of the Memorial Union (the Union on the terrace) of UW-Madison.

EXCURSION: An excursion is being planned to the famous "House on the Rock" in nearby Spring Green. This is more than a house; it is a veritable large museum of mechanical and electrical contraptions with an incredible in-door carrousel.

MORE INFORMATION: A more detailed flyer containing registration, accommodation, paper submission, and other information will be mailed in the early fall of 1997. Contact:

Richard A. Brualdi, Math Dept., Van Vleck Hall, 480 Lincoln Drive, University of Wisconsin, Madison, WI 53706
phone: 608-263-3051 e-mail: brualdi@math.wisc.edu http://www.math.wisc.edu/~brualdi

Just as for the Penn State PI conference, the IMA is also supporting the Workshop as follows. Mathematicians from the Participating Institutions of the IMA are eligible to receive IMA/PI funding, where available, to come to the Workshop. Application to use IMA/PI funds for the workshop should be made directly to the mathematician's own department chair.

f. Software links on the IMA World-wide web home page

One-stop shopping for scientific software

Two workshops held during the Spring 1997 activity of the 1997–98 IMA Program on "Mathematics in High-Performance Computing" included the presentation of software packages which were installed for the purpose and linked from the IMA web page `http://www.ima.umn.edu`. This software is still available and will be maintained there for the near future. This provides a virtually unique resource for people in the scientific computation community to try out and compare various software packages without having to get separate permission from each developer.

Eight software packages for solving **partial differential equations** were presented at the April 21–25, 1997 IMA tutorial on **PDE Software**. The tutorial was organized by Petter Bjørstad of the University of Bergen. The software packages are: FEAT, presented at the tutorial by Stefan Turek of the University of Heidelberg; DIFFPACK, by Hans Petter Langtangen of the University of Oslo; FreeFEM, by Olivier Pironneau of Université Pierre et Marie Curie; MATLAB/PDEtool, by Lars Langemyr of COMSOL; FEEL, by Hidehiro Fujio of NEC; PETSc, by Barry Smith of Argonne National Laboratory; PLTMG, by Randy Bank of the University of California at San Diego; and UG, by Henrik Rentz-Reichert of the University of Stuttgart. These packages represent a wide range of user-friendliness and of scientific applications.

Seven software packages for **automatic differentiation** (that is: for generating high-level code for the derivatives of a function, given a procedure, usually recursive, which computes the function) were presented at the IMA Special Workshop on **Template-Driven Automatic Differentiation for Large-Scale Scientific and Engineering Applications** June 29–July 3, 1997. The organizers were Thomas Coleman (Cornell University), Fadil Santosa (University of Minnesota) and William Symes (Rice University). The workshop was sponsored jointly by the IMA with the Cornell Theory Center and with CRPC, Rice University. The software packages are: ADIC, presented at the workshop by Lucas Roh of Argonne National Labs; ADIFOR, ADIFOR-MP and ADJIFOR, by Alan Carle of Rice University; Odyssée, by Christele Faure of INRIA Sophia Antipolis; TAMC, by Ralf Giering of the Max-Planck Institut für Meteorologie, Hamburg; PADRE-2, by Koichi Kubota of Chuo University; ADOL-C, by Jean Utke of the Technical University of Dresden; and ADMIT – II, by Arun Verma of Cornell University.

The IMA would appreciate any comments about these software packages, especially from (1) people who have scientific problems they need to solve; (2) people who have tried more than one of these packages and can compare their qualities; and (3) people who have used one or more of these packages in an educational setting. The IMA will maintain confidentiality about the identity of those reporting their experiences.

g. Weekly IMA Seminar List available by list server

The IMA is happy to offer its e-mail mailing list service. The mailing list "weekly" is a distribution each Thursday of the next week's schedule of IMA seminars and events. If you wish to subscribe, simply send an e-mail message to `imalists@ima.umn.edu` whose first line is of the form

```
subscribe weekly
```

If your preferred e-mail address is different from the one from which you are sending the request, the first line should be

```
subscribe weekly you@e.mail.address
```

The subject line and the rest of the message are ignored. Questions or problems should be sent to `owner-weekly@ima.umn.edu`.

The current week's updated seminar list may also be obtained via `finger seminar@ima.umn.edu`.

II. IMA CALENDAR

1. STATISTICS IN THE HEALTH SCIENCES, July 7–August 29, 1997

July 7–11: Genetics

July 14–18: Imaging

July 21–25: Diagnosis and Prediction

July 28–August 8: Design & Analysis of Clinical Trials

August 18–22: Statistics & Epidemiology: Environment & Health

2. EMERGING APPLICATIONS OF DYNAMICAL SYSTEMS, September 1997–June 1998

Fall 1997: Numerical Analysis of Dynamical Systems

September 4–9: Tutorial on **Numerical Methods for Bifurcation Problems**

September 15–19: Workshop on **Numerical Methods for Bifurcation Problems**

September 29–October 3: Workshop on **Large-Scale Dynamical Systems**

October 23–24: Tutorial on **Multiple-Time-Scale Dynamical Systems**

October 27–31: Workshop on **Multiple-Time-Scale Dynamical Systems**

November 17–21: Workshop on **Dynamics of Algorithms**

Winter 1998: Dynamics in Physiology and Chemistry
See below for details of tutorials, workshops and participants.

Spring 1998: Symmetry and Pattern Formation

April 27–May 1: Workshop on **Nonlinear Identification and Control**

May 11-15: Workshop on **Pattern Formation in Continuous and Coupled Systems**

June 1–5: Workshop on **Animal Locomotion and Robotics**

3. CODING AND CRYPTOGRAPHY, July 6–17, 1998

4. MATHEMATICS IN BIOLOGY, September 1998–June 1999

Fall 1998: Theoretical Problems in Developmental Biology and Immunology

September 2–4: Tutorial on **Mathematical and Computational Issues in Pattern Formation**

September 7–11: Workshop on **Pattern Formation and Morphogenesis: The Basic Process**

September 14–18: Workshop on **Pattern Formation and Morphogenesis: Model Systems**

October 7–8: Tutorial on **Immunology, Cell Signaling, the Physiology of the Immune System & the Dynamics of the Immune Response**

October 12–16: Workshop on **Immune System Modeling & Cell Signaling**

October 19–23: Period of Concentration on **Forging an Appropriate Immune Response as a Problem in Distributed Artificial Intelligence**

November 9–13: Workshop on **Dynamic and Control of AIDS**

Winter 1999: Mathematical Problems in Physiology

January 4–8: Workshop on **Cell Adhesion and Motility**

January 25–29: Workshop on **Computational Modeling in Biological Fluid Dynamics**

February 8–12: Workshop on **Membrane Transport and Renal Physiology**

February 13: Tutorial on **Hormones**

February 15–19: Workshop on **Endocrinology: Mechanism of Hormone Secretion and Control**

March 5: Tutorial on **Audition**

March 8–12: Workshop on **Audition**

Spring 1999: Dynamic Models of Ecosystems and Epidemics

April 19–23: Workshop on **Local Interaction and Global Phenomena in Vegetation and other Systems**

May 13–14: Tutorial on **Introduction to Epidemiolgy & Immunology**

May 17–21: Workshop on **Mathematical Approaches for Emerging and Reemerging Infectious Diseases**

June 7–11: Workshop on **From Individual to Aggregration: Modeling Animal Grouping**

5. REACTIVE FLOWS & TRANSPORT PHENOMENA, September 1999–June 2000

Fall 1999: Combustion

Winter 2000: Natural Resources and Environment

Spring 2000: Multiscale and Transition Regimes

Academic Year Program:

III. EMERGING APPLICATIONS OF DYNAMICAL SYSTEMS

September 1, 1997 - June 30, 1998

Organizers: John Guckenheimer (Chairman) (Cornell University)
Eusebius Doedel (Concordia University)
Martin Golubitsky (University of Houston)
Yannis Kevrekidis (Princeton University)
Rafael de la Llave (University of Texas, Austin) and
John Rinzel (National Institutes of Health)

Dynamical systems theory describes general patterns found in the solutions of systems of nonlinear differential equations. The theory focuses upon those equations representing the change of processes in time. Geometric and analytic study of simple examples has led to tremendous insight into universal aspects of nonlinear dynamics. Experimental studies in diverse areas ranging from fluid flows to chemical reactions to laser dynamics to cardiac rhythms to neural output have confirmed the ubiquity of these dynamical patterns. Harnessing theoretical advances in the mathematics for the solution of larger, more complex practical problems requires further effort in understanding algorithmic and computational issues related to dynamical systems, extensions of the theory to important classes of systems that arise in applications, and attention to the modeling of complex systems that are accessible to only limited measurements of their components.

Work at applying the methods developed by dynamical systems theory to "real world" problems has been a thoroughly interdisciplinary effort. For over fifteen years, there has been a lively dialogue between mathematicians, scientists and engineers concerning the observation and interpretation of dynamical patterns in laboratory and natural systems. To some extent, missing from this discussion has been a set of quantitative models that accurately represent the behavior of the observed systems. The patterns identified by the theory are qualitative, and frequently the theory has been used to classify patterns rather than to build models that can be used for purposes of design or prediction. Computational capabilities have been a limiting factor in constructing such models since they seldom lend themselves to solution solely with analytic methods.

This program offers a set of activities that address the issue of applying dynamical systems methods to a wider circle of problems. There are three components to our approach: a focus on the algorithms that underlie the computation of system behavior, a focus on particular application areas that appear timely for rapid scientific advances through the use of dynamical systems methods, and emphasis upon areas in which existing mathematical theory provides an inadequate substrate for work with applications. The application areas we have selected involve physiological and chemical processes.

Fall Quarter (September 1 – December 30, 1997): **Numerical Analysis of Dynamical Systems**

Winter Quarter (January 2 – March 31, 1998): **Dynamics in Physiology and Chemistry**

Spring Quarter (April 1 – June 30, 1998): **Symmetry and Pattern Formation**

Winter 1998 Program: Dynamics in Physiology and Chemistry

1 Workshop (January 14–23, 1998): Computational Neuroscience

Organizers: John Rinzel (NIH), Nancy Kopell (Boston), Larry Abbott (Brandeis)

Of primary interest to neuroscientists are the roles of the highly nonlinear intrinsic properties of individual neurons and coupling properties between cells that determine the dynamical activity of neuronal networks. Unique mathematical features of cell-based neuronal models that underlie complex spatio-temporal patterns are the multiple and vast time scales of ionic currents (from milliseconds to seconds) and the circuit properties which include local as well as long-range coupling, possibly with random connectivity, and with kinetic aspects (time constants for decay of synaptic variables). This workshop will consist of a few intense two- to three-day periods, bringing together experimentalists and theoreticians for focusing on specific systems for which some model development has begun. Topics will include stereotypical dynamical behavior such as network rhythms seen during sleep and epilepsy, as well as more complex phenomena associated with goal-directed behavior or perception. Models for such higher-level cognitive function may assume that cell-based properties have been averaged into more macroscopic descriptions. Experimental model systems include brain slices of thalamus, hippocampus, and cortex and in vivo recordings in sensory and motor areas during visual, auditory, and movement tasks. The workshop's first two to three days will consist of tutorials to help introduce for non-specialists the mathematics and basic physiology of single-neuron dynamics, neuronal interactions and network modeling, and possibly issues of neuronal coding.

CONFIRMED WORKSHOP VISITORS: January 14–23, 1998 (as of 7/11)

Workshop: Computational Neuroscience

ABBOTT, LARRY	Brandeis University	JAN 13 - 23
BAER, STEVE	Arizona State University	JAN 18 - 23
BERTRAM, RICHARD	Penn State-Behrend	JAN 13 - 23
BOOTH, VICTORIA	New Jersey Inst. of Technology	JAN 13 - 23
BOWER, JIM	Caltech	JAN 13 - 23
BUTERA, ROB	NIH	JAN 13 - 23
CAMPBELL, SUE ANN	University of Waterloo	JAN 13 - 23
CHAPMAN, BARBARA	Univ. of California, Davis	JAN 13 - 23
CHOW, CARSON	Boston University	JAN 13 - 23
CROOK, SHARON	NIH	JAN 1 - 30
DAN, YANG	University of California	JAN 13 - 23
DAYAN, PETER	M.I.T.	JAN 13 - 23
DESTEXHE, ALAIN	Laval University School of Medicine	JAN 13 - 23
FERSTER, DAVID	Northwestern University	JAN 13 - 23
GERSTNER, WULFRAM	Federal Institute of Techn. Lausanne	JAN 1 - 30
GOLOMB, DAVID	Ben-Gurion University of the Negev	JAN 1 - 30

HANSEL, DAVID	École Polytechnique	JAN 1 - 30
HOFER, THOMAS	MPI Physics of Complex Systems, Dresden	JAN 13 - 23
IZHIKEVICH, EUGENE M.	Arizona State University	JAN 13 - 23
JUNG, RANU	University of Kentucky	JAN 13 - 23
KEIZER, JOEL	Univ. of California, Davis	JAN 12 - 24
KIEMEL, TIM	University of Maryland	JAN 13 - 23
LEVY, WILLIAM B.	Univ. of Virginia-Health Sciences Ctr.	JAN 13 - 23
LEWIS, JOHN	Univ. of California, San Diego	JAN 13 - 23
LISMAN, JOHN	Brandeis University	JAN 13 - 23
LONGTIN, ANDRE	University of Ottawa	JAN 13 - 23
LYTTON, BILL	University of Wisconsin	JAN 13 - 23
MANOR, YAIR	Brandeis University	JAN 13 - 23
MATO, GERMAN	Centro Atomico Bariloche	JAN 2 - 30
MCLAUGHLIN, DAVID	Courant Institute-NYU	JAN 13 - 23
MILLER, KEN	Univ. of California San Francisco	JAN 13 - 23
NADIM, FARZEN	Brandeis University	JAN 1 - 30
PINTO, DAVID	University of Pittsburgh	JAN 1 - 30
RINZEL, JOHN	National Institutes of Health	JAN 12 - 24
RUSH, MAUREEN	Cal State Univ. Bakersfield	JAN 13 - 23
SHAPLEY, ROBERT	New York University	JAN 13 - 23
SHERMAN, ARTHUR	NIH	JAN 13 - 23
SHERMAN, MURRAY	State University of New York	JAN 13 - 23
SILLITO, ADAM M.	Ophthalmology, Univ. College London	JAN 13 - 23
SKAGGS, BILL	University of Pittsburgh	JAN 13 - 23
SKINNER, FRANCIS	Toronto Hospital	JAN 13 - 23
SMITH, GREGORY	NIH	JAN 13 - 23
SOMERS, DAVID	MIT	JAN 1 - 30
SOMPOLINSKY, HAIM	Hebrew University	JAN 13 - 23
SOTO-TREVINO, CHRISTINA	Boston University	JAN 1 - 30
SWINDALE, NICHOLAS V.	University of British Columbia	JAN 13 - 23
TERMAN, DAVID	Ohio State University	JAN 1 - 30
THEUNISSEN, FREDERIC	Univ. of California at San Francisco	JAN 13 - 23
TRAUB, ROGER	IBM Watson Research Center	JAN 13 - 23
TROYER, TODD	Univ. of California at San Francisco	JAN 13 - 23
TSODYKS, MISHA V.	Weizmann Institute of Science	JAN 13 - 23
VAN HEMMEN, J. LEO	Techn. Univ. München	JAN 13 - 23
WANG, DELIANG	Ohio State University	JAN 13 - 23
WANG, XIAO-JING	Brandeis University	JAN 13 - 23
WHITE, JOHN A.	Boston University	JAN 13 - 23
WILSON, CHARLES	Univ. of Tennessee Health Sciences	JAN 13 - 23

2 Tutorial (February 5–6, 1998): Calcium Dynamics in Cells

Organizer: Joel Keizer (Davis)

3 Workshop (February 9–13, 1998): Calcium Dynamics in Cells

Organizers: Joel Keizer (chair), John Rinzel (NIH), Albert Goldbeter (Brussels)

Dynamic changes in cellular free-calcium concentrations are essential for a great variety of cellular processes, including intra- and extra-cellular signalling processes, muscle contraction, and cell motility. Using modern techniques in calcium imaging, experimentalists have recently resolved spatio-temporal patterns (oscillations and various types of nonlinear waves) in both isolated cells and tissue. These dynamical phenomena involve specific

molecular mechanisms controlling calcium influx and efflux through the cell's outer membrane (voltage-gated ion channels, calcium exchangers and pumps) as well as calcium release mechanisms from internal compartments (sarcoplasmic or endoplasmic reticulum and mitochondria). A number of complex signalling pathways coupling these mechanisms have been uncovered in the laboratory, and realistic models of these processes are being developed. The workshop will be preceded by a two-day tutorial that provides the necessary biological background for non-experts and an overview of current models. Workshop participants will include a mix of experimental cell biologists, theorists currently developing mathematical models, and mathematicians from the dynamical systems community. The workshop will explore important current biological questions such as the role of local calcium gradients in cells, how the stochastic properties of individual molecular entities (e.g., ion channels and hormone receptors) lead to organized dynamical behavior, and how calcium signals are transduced into physiological function. The workshop will close with an extended discussion of new mathematical challenges that this area presents in dynamical systems theory.

CONFIRMED WORKSHOP VISITORS: February 9–13, 1998 (as of 7/11)

Workshop: Calcium Dynamics in Cells

ARMBRUSTER, HANS DIETER	Arizona State University	FEB 8 - 13
ATWATER, ILLANI	NIDDK, NIH	FEB 8 - 13
BUGRIM, ANDREJ	Brandeis University	FEB 8 - 13
CHARLES, ANDREW	UCLA–SOM	FEB 8 - 13
DE YOUNG, GARY	Mesa State College of Colorado	FEB 8 - 13
DUPONT, GENEVIEVE	Univ. Libre de Bruxelles	FEB 8 - 13
EPSTEIN, IRVING	Brandeis University	FEB 8 - 13
FRIEDMAN, MARK	University of Alabama-Huntsville	FEB 8 - 13
HUNTER, JOHN	Univ. of California-Davis	FEB 8 - 13
KEIZER, JOEL	Univ. of California-Davis	FEB 8 - 13
KISAALITA, WILLIAM S.	University of Georgia	FEB 7 - 13
LECHLEITER, JAMES D.	University of Virginia	FEB 8 - 13
LI, YUE-XIAN	Univ. of California-Davis	FEB 8 - 13
LOEW, LESLIE	University of Conn. Health Center	FEB 8 - 13
MAGNUS, GERHARD		FEB 8 - 13
MOGILNER, ALEX	Univ. of California-Davis	FEB 8 - 13
MUIRA, ROBERT	Univ. of British Columbia	FEB 8 - 13
NUCCITELLI, RICHARD	University of California-Davis	FEB 8 - 13
OTHMER, HANS	Univ. of Utah	FEB 8 - 13
PARKER, IAN	Univ. of California, Irvine	FEB 8 - 13
PEARSON, JOHN	Los Alamos National Laboratory	FEB 8 - 13
PERNAROWSKI, MARK	Montana State University	FEB 8 - 13
PESKOFF, ARTHUR	Univ. of California-Los Angeles	FEB 8 - 13
RAO, RAJ R.	University of Georgia	FEB 7 - 13
RINZEL, JOHN	National Institute of Health	FEB 8 - 13
ROJAS, EDUARDO E.	NIH	FEB 8 - 13
RUSSELL, JAMES T.	NIH	FEB 8 - 13
SANDERSON, MICHAEL J.	Univ. of Massachusetts Med. School	FEB 8 - 13
SHERMAN, ARTHUR	NIH	FEB 8 - 13
SHOWALTER, KENNETH	West Virginia University	FEB 8 - 13
SILVER, ROBERT	Marine Biological Laboratory	FEB 8 - 13
SMITH, GREGORY D.	Math. Research Branch, NIDDK, NIH	FEB 8 - 13
SMOLEN, PAUL	University of Texas-Medical School	FEB 8 - 13
SNEYD, JAMES	University of Michigan	JAN 1 - JUN 30
STOJIKOVIC, STANKO	NICHD, NIH	FEB 8 - 13
TERMAN, DAVID	Ohio State Univ.	FEB 8 - 13
THOMAS, ANDREW P.	Thomas Jefferson University	FEB 8 - 13
TYSON, JOHN	Virginia Polytechnic Inst. & State Univ.	FEB 8 - 13
ZUCKER, ROBERT S.	Univ. of California-Berkeley	FEB 8 - 13

4 Workshop (March 9–14, 1998): Cardiac Rhythms

Organizers: Jim Collins (Boston), James Keener, Charles Peskin (Courant) and Rai Winslow (Johns Hopkins)

Spatio-temporal patterns of electrical activity over the heart cause the muscle to contract. Simplified models show normal wave propagation, as well as arrhythmias such as spontaneous spiral wave generation. Complicating factors for modelers include differing nonlinear properties in different regions, anisotropy in the conduction pathways (orientation of tissue with depth in heart wall), and branching in the Purkinje system which triggers the muscle electrical activity. Large scale 3-D computational models as well as reduced models based on singular perturbation descriptions and kinematics of spiral cores have led to insights into cardiac physiology, and for excitable media more generally.

CONFIRMED WORKSHOP VISITORS: March 9–14, 1998 (as of 7/11)

Workshop: Cardiac Rhythms

ARTS, THEO	University of Limburg	MAR 8 - 15
CHAY, TERESA	University of Pittsburgh	MAR 8 - 15
COLLINS, JIM	Boston University	MAR 8 - 14
DITTO, WILLIAM	Georgia Institute of Technology	MAR 8 - 15
GARFINKEL, ALAN	Cardiology-UCLA	MAR 8 - 15
GLASS, LEON	McGill University	MAR 8 - 15
HOLDEN, ARUN	University of Leeds	MAR 8 - 15
IRVINE, LISA	Johns Hopkins University	MAR 8 - 14
KARMA, ALAIN	Northeastern University	MAR 8 - 15
MCCULLOCH, ANDREW	University of California - San Diego	MAR 8 - 15
MIURA, ROBERT	University of British Columbia	MAR 8 - 15
PESKIN, CHARLES S.	New York University	MAR 8 - 15
RUDY, YORAM	Case Western Reserve University	MAR 11 - 15
SNYDERS, DIRK	Vanderbilt Univ. School of Medicine	MAR 8 - 15
STARMER, FRANK	Duke University	MAR 8 - 15
TABER, LARRY	University of Rochester	MAR 8 - 15
WARMAN, EDUARDO	Medtronic, Inc.	MAR 8 - 15
WINSLOW, RAI	Johns Hopkins University	MAR 8 - 14
XIE, MIN	University of Utah	MAR 1 - 31

CONFIRMED LONG-TERM WINTER 1998 PARTICIPANTS (as of 7/11)

Four Weeks or More

Dynamics in Physiology and Chemistry

BARKLEY, DWIGHT	University of Warwick	AUG 15 - JUN 30
CARVER, SEAN G.	Cornell University	SEP 1 - JUL 30
CROOK, SHARON	NIH	JAN 1 - 30
FOIAS, CIPRIAN	Indiana University	JAN 1 - JUN 30
FRENCH, DONALD	University of Cincinnati	SEP 1 - AUG 31
GERSTNER, WULFRAM	Federal Institute of Techn. Lausanne	JAN 1 - 30
GOLOMB, DAVID	Ben-Gurion University of the Negev	JAN 1 - 30
GOMES, GABRIELA	University of Warwick	SEP 1 - MAY 31
GUCKENHEIMER, JOHN	Cornell University	SEP 1 - JUN 30
HANSEL, DAVID	École Polytechnique	JAN 1 - 30
HU, BEI	University of Notre Dame	SEP 1 - MAY 31

JIANG, MIAOHUA	Georgia Institute of Technology	SEP 1 - AUG 31
JOHNSON, MARK	Princeton University	SEP 1 - AUG 31
JOLLY, MIKE	Indiana University	JUL 14 - AUG 1
KING, GREGORY P.	University of Warwick	SEP 1 - MAY 31
LOPEZ, GILBERTO	Institute for Mathematics	SEP 1 - AUG 31
LUST, KURT	K. University Leuven	SEP 1 - AUG 31
MAHADEVAN, L.	M.I.T.	SEP 1 - JAN 31
MANTEL, ROLF-MARTIN	University of Warwick	SEP 1 - AUG 31
MATO, GERMAN	Centro Atomico Bariloche	JAN 2 - 30
MILIK, ALEXANDRA	Technische Universität Wien	SEP 1 - JUN 30
NADIM, FARZEN	Brandeis University	JAN 1 - 30
OLIVA, RICARDO	Cornell University	SEP 1 - AUG 31
OSIPCHUK, MARINA V.	Univ. of California, Irvine	SEP 1 - AUG 31
PINTO, DAVID	University of Pittsburgh	JAN 1 - 30
POSBERGH, THOMAS. A.	University of Minnesota	SEP 1 - JUN 15
ROGERS, KATHLEEN	University of Maryland	SEP 1 - AUG 31
SHARDLOW, TONY	Stanford University	SEP 1 - AUG 31
SNEYD, JAMES	University of Michigan	JAN 1 - JUN 30
SOMERS, DAVID	MIT	JAN 1 - 30
SOTO-TREVINO, CHRISTINA	Boston University	JAN 1 - 30
TUCKERMAN, LAURETTE	LIMSI, Orsay	SEP 5 - JUN 30
TERMAN, DAVID	Ohio State University	JAN 1 - 30
VARGHAESE, ANTHONY	University of Oxford	SEP 1 - AUG 31
WANG, X.J.	University of Pittsburgh	JAN 2 - MAR 31
WATANABE, SHINYA	Niels Bohr Institute	SEP 3 - AUG 31
WECKESSER, WARREN	Rensselaer Polytechnic Institute	SEP 1 - AUG 31
XIE, MIN	University of Utah	MAR 1 - 31

IV. THE IMA VOLUMES IN MATHEMATICS AND ITS APPLICATIONS

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Volume 96: Wave Propagation in Complex Media
Editor: George Papanicolaou

This volume combines the proceedings of two workshops: one devoted to *Wavelets, Multigrid and other Fast Algorithms (Multipole, FFT) and their Use in Wave Propagation*, and another devoted to *Waves in Random and other Complex Media.*

The majority of the chapters deal with the effects of inhomogeneities of wave propagation both theoretically and computationally. They include topics such as waves in random media, coherent effects in scattering for random systems with discrete spectrum, interaction of microwaves with sea ice, scattering in magnetic field, surface waves, seismogram envelopes, backscattering, polarization mode dispersions, and spatio-temporal distribution of seismic power. Several articles describes numerical methods, such as fast algorithms for solving electromagnetic scattering problems, and the panel clustering methods in 3-d BEM.

Volume 97: Random Sets: Theory and Applications
Editors: John Goutsias, Ronald P.S. Mahler, and Hung T. Nguyen

On August 22–24, 1996, an international group of researchers convened, under the auspices of the *Institute for Mathematics and Its Applications* (IMA), a scientific workshop on the *Applications and Theory of Random Sets.* The articles in this volume address theoretical and applied aspects of this field in diverse areas of applications such as Image Modeling and Analysis, Information/Data Fusion, and Theoretical Statistics and Expert Systems. Emphasis is given to potential applications in engineering problems of practical interest. This volume is of interest to mathematicians, engineers and scientists who are interested in the potential application of random set theory to practical problems in imaging, information fusion, and expert systems.

Volume 98: Particulate Flows: Processing and Rheology
Editors: Donald A. Drew, Daniel D. Joseph, and Stephen L. Passman

This volume presents the proceedings of a workshop held at the Institute for Mathematics and its Applications. This institute is founded by the National Science Foundation to promote the interchange of ideas between applied mathematics and the other sciences. The present volume fits in that framework by bringing together ideas of mathematicians and researchers in the physical scientists in the area of particulate flow and rheology.

Flow of particles in a fluid occur in food processing, catalytic processing, slurries, coating, paper manufacturing, particle injection molding and filter operation. In many of these processes, the rheology of such materials as they undergo transport and processing is important in design, operation, and efficiency. Consequently, using these materials represents a technological challenge.

In spite of the phenomenal advances in computation and computers, simulation of the motion of more than a few particles in a fluid is impractical. Therefore, effective media models and two-fluid models are important in the description of particle-fluid flows.

The volume offers papers addressing issues of ensemble averaging, microstructure behavior, and the analysis of two-continua models. The span of practical to theoretical approaches to particulate flow makes this volume appeal to researchers interested in deriving or applying particulate flow models.

The publisher and the symposium organizers hope that this volume will contribute to increasing dialog between mathematicians and physical scientists interested in particulate flow.

Volume 99: Mathematics of Multiscale Materials
Editors: Kenneth M. Golden, Geoffrey R. Grimmett, Richard D. James, Graeme W. Milton, and Pabitra N. Sen

Polycrystalline metals, porous rocks, colloidal suspensions, epitaxial thin films, gels, foams, granular aggregates, sea ice, shape-memory metals, magnetic materials, and electro-rheological fluids are all examples of materials where an understanding of the mathematics on the different length scales is a key to interpreting their physical behavior. In their analysis of these media, scientists coming from a number of disciplines have encountered similar mathematical problems, yet it is rare for researchers in the various fields to meet. The 1995–96 program at the Institute for Mathematics and its Applications was devoted to Mathematical Methods in Materials Science, and was attended by material scientists, physicists, geologists, chemists, engineers, and mathematicians. The present volume contains papers which have emerged from four of the workshops held during the year, focusing on the following areas: *Disordered Materials*; *Interfaces and Thin Films*; *Mechanical Response of Materials from Angstroms to Meters*; and *Phase Transformation, Composite Materials and Microstructure*. The scales treated in these workshops ranged from the atomic to the microstructural to the macroscopic, the microstructures from ordered to random, and the treatments from "purely" theoretical to the highly applied. Taken together, these works form a compelling and broad account of many aspects of the science of multiscale materials, and will hopefully inspire research across the self-imposed barriers of twentieth century science.

Volume 100: Mathematics in Industrial Problems, Part 10
by Avner Friedman

This is the tenth volume in Avner Friedman's collection of Mathematics in Industrial Problems. These books aim to foster interaction between industry and mathematics at the "grass roots" level of specific problems. The problems presented in this book arise from models developed by industrial scientists engaged in research and development of new or improved products. The author's sources are affiliated with a variety of industrial enterprises including Motorola, IBM, Ford Motor Company, Eastman Kodak, 3M, AT&T Labs, Honeywell, and Schlumberger-Doll Research.

The topics explored in this volume include semiconductor devices and micro-accelerometers, computational aeroacoustics, coating flows, coalescence, electrorheological fluids, mass transport in particle-loaded beds, metal cutting processes, network traffic analysis, risk management, micromagnetics and cooling systems.

Open problems and references to the mathematical literature are incorporated into most of the chapters. The final chapter contains solutions to some of the problems raised in previous parts of the series Mathematics in Industrial Problems, published in the IMA Volumes in Mathematics and its Applications.

Volume 101: Nonlinear Optical Materials
Editor: Jerome V. Moloney

Mathematical methods play a significant role in the rapidly growing field of nonlinear optical materials. This volume discusses a number of successful or promising contributions. The overall theme of this volume is twofold: (1) the challenges faced in computing and optimizing nonlinear optical material properties; and (2) the exploitation of these properties in important areas of application. These include the design of optical amplifiers and lasers, as well as novel optical switches. Research topics in this volume include how to exploit the magnetooptic effect, how to work with the nonlinear optical response of materials, how to predict laser-induced breakdown in efficient optical devices, and how to handle electron cloud distortion in femtosecond processes.

Forthcoming Volumes:

1992–1993: *Control Theory*

Robotics

1995–1996: *Mathematical Methods in Materials Science*

Numerical Methods for Polymeric Systems

Topology and Geometry in Polymer Science

1996 Summer Programs:

Emerging Applications of Number Theory

1996–1997: *Mathematics in High Performance Computing*

Algorithms for Parallel Processing

Evolutionary Algorithms

The Mathematics of Information Coding, Extraction and Distribution

Molecular Structure: Dynamics, Geometry and Topology

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Mathematical and Computational Issues in Drug Design

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Parallel Solution of Partial Differential Equations