INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS

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The IMA was founded by and receives major support from the National Science Foundation.

IMA UPDATE

Fall 1999

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

CONTENTS

Version of November 22, 1999

I. NEWS AND NOTES

a. Board of Governors Selects Program Topics: Geometric Methods in Inverse Problems and PDE Control for Summer 2001 and Optimization for the 2002-2003 Annual Program

The Board of Governors approved a proposal to devote a Summer 2001 Program to the topic, **Geometric Methods in Inverse Problems and PDE Control**. The organizing committee consists of Chris Croke (University of Pennsylvania), Irena Lasiecka (University of Virginia), Gunter Uhlmann (University of Washington), and Michael Vogelius (Rutgers University). The proposal outlines a two week program to be held (tentatively) July 16 – 27, 2001.

This summer program's goals are to bring together geometers with researchers in inverse problems and control of PDE to facilitate exchange of ideas and encourage collaboration; to make tools of differential geometry known to those working in inverse problems and control, and to open new areas of research in geometry. The workshop will for instance explore the use of inverse problem and control methods to rigidity problems in geometry. This will be a two week program in which Week 1 will emphasize Geometric and PDE methods and Week 2 will focus on applications of these techniques to inverse and control problems. Both weeks will begin with overview talks designed to set the stage for the program. The presence of several talks of a survey nature will make this workshop an ideal venue for young researcher wanting to get involved in these fields.

For the most recently updated information, see **http://www.ima.umn.edu/GM/**

The Board of Governors also approved a proposal to devote the academic year September 2002 – June 2003 to the topic, **Optimization**. The organizing committee consists of Donald Goldfarb (Columbia), Bill Pulleyblank (IBM Research), Bill Cook (Rice), Tom Coleman (Cornell), John Birge (Northwestern), Brenda Dietrich (IBM Research), and Prabhakar Raghavan (IBM Research).

The year is divided into three quarters whose topics are "Supply Chain and Logistics Optimization" (Fall 2002), "New Optimization Paradigms and Approaches" (Winter 2003), and "Information Technology and Optimization" (Sprint 2003).

The proposal outlines tentative plans for workshops on "Supply Chain Management" , "Computational Methods for Large Scale Integer Programs", "Travel and Transportation", "Nonconvex and Global Optimization" , "Optimization in Design and Inverse Problems" "Semidefinite Programming and Robust Optimization", "Communications Design", and "Data Analysis and Optimization".

As with all IMA programs, a primary goal of these workshops is to educate and interest mathematicians in the mathematical and scientific problems that arise in these dynamic and challenging areas of science and technology.

The most recently updated information, see **http://www.ima.umn.edu/optimization/**

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b. New Members Elected to the Board of Governors

At its annual meeting in Minneapolis on 17 October 1999, the IMA Board of Governors elected four distinguished scientists as new members, who have agreed to serve on the board for three years beginning January 1, 2000. They are Joan Feigenbaum of AT&T, Bill Gear of NEC, Fan Chung Graham of UC San Diego and Jim Yorke of the University of Maryland.

Retiring members as of 31 December 1999 are Robert Calderbank (AT&T Bell Labs), Rosemary Chang (Silicon Graphics), John Polking (Rice University), and Ridgway Scott (University of Houston).

The IMA would like to express its deep gratitude to Drs. Calderbank, Chang, Polking, and Scott for their ideas and dedication in serving on the Board during the past three years. Continuing Board members are Douglas Arnold (Pennsylvania State University), Lynne Billard (University of Georgia), Jennifer Chayes (Microsoft), Richard Karp (University of Washington), James Paul Keener (University of Utah), Thomas Magnanti (Massachusetts Institute of Technology), and Juan Meza (Sandia National Laboratory), and Paul H. Rabinowitz (Univ. of Wisc.-Madison).

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c. Program Ideas

The IMA continually asks members of the mathematical sciences community for their ideas for future programs. This community includes–in addition to mathematicians–industrial scientists, scientists in government labs, university scientists, engineers, etc. whose work brings them in contact with problems involving mathematical challenges at all levels.

Future programs are sought which could be carried out through:

- a one-week workshop on a topic of mathematical/scientific interest;
- a one-month period of concentration bringing mathematicians and other scientists together to work on a topic of interest;
- a two- to seven-week Summer program consisting of a series of one-week workshops treating subtopics of a topic of interest; or
- a ten-month Annual Program including long-term senior visitors, eight postdocs, six to ten one-week workshops, three to ten tutorials, and weekly seminars.

Please contact the IMA Director, Willard Miller, with your ideas:

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FAX: (612) 626-7370

Please see the enclosed flyer or http://www.ima.umn.edu/ideas.html for more detailed information.

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d. 1999–2000 Reactive Flow and Transport Phenomena Postdocs Selected

With the advice of the organizers of the 1999-2000 year on **Reactive Flow and Transport Phenomena,** the IMA has chosen nine postdoctoral members for the period September 1, 1999 to August 31, 2001. As was the case last year, all postdocs were offered two year appointments. These postdocs will be active participants in all activities of the annual program. They were chosen from a long list of well-qualified recent Ph. D. recipients.

First Year Postdocs

NAME	PH. D. INSTITUTION	ADVISOR
Javier Armendariz	Northwestern University	Moshe Matalon
Yalchin Efendiev	California Institute of Technology	Thomas Hou
Takumi Hawa	Rensselaer Polytechnic Inst.	Zvi Rusak
Alexei Novikov	Stanford university	George Papanicolaou
Yong Kim	University of Wisconsin	Anthanasios E. Tzavaras

Second Year Postdocs

NAME	PH. D. INSTITUTION	ADVISOR
Kevin Anderson	University of Arizona	Joseph Watkins
Bruce Ayati	University of Chicago	Todd F. Dupont

Industrial Postdocs

NAME	Company	PH. D. INSTITUTION	ADVISOR
Nicolas Coult	FMA&H	University of Colorado	Gregory Beylkin
Jay Gopalakrishnan	Medtronic	Texas A& M University	J. H. Bramble & J.E. Pasciak
Dimitri Kirill	Motorola	Northwestern University	Michael Miksis
Nilima Nigam	Seagate	University of Delaware	George Hsiao
Anthony Varghese	Endocardial Solutions	Univ. of Oxford (postdoc)	
Aleksandar Zatezalo	Lockheed Martin	University of Minnesota	Nicolai Krylov

Other Postdoctoral Appointments

NAME	PH. D. INSTITUTION	ADVISOR
Henning Struchtrup	Universität of Berlin	Ingo Müller
Rho Shin Myong	The University of Michigan	Philip Roe

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e. Funding support for IMA 1998 – 1999 programs

The IMA expresses its thanks to the funding agencies, institutions and corporations who provided financial support to the IMA during the programming period September 1, 1998 – August 31, 1999. Major support was provided by the National Science Foundation, which founded the IMA, and by the University of Minnesota, the host institution.

Support for the September 8-12 workshop "Pattern Formation and Morphogenesis: The Basic Process" and its companion the September 14-18 workshop "Pattern Formation and Morphogenesis: Model Systems" as well as the the May 17-21 workshop "Mathematical Approaches for Emerging and Reemerging Infectious Diseases" was provided by the National Institute of General Medical Sciences, National Institutes of Health (NIH-NIGMS).

Support for the April 24-27 HOT TOPIC workshop "Challenges and Opportunities in Genomics: Production, Storage, Mining and Use" was provided by 3M.

Support for the July HOT TOPIC workshop "Decision Making Under Uncertainty: Energy and Environmental Models" was provided by Schlumberger.

Corporate support was received from the IMA Participating Corporations: Eastman Kodak, EPRI, Ford, Fujitsu, General Motors, Honeywell, IBM, Lockheed Martin, Lucent Technologies, Medtronic, Motorola, Siemens Telcordia and 3M.

Institutional support was received from the IMA Participating Institutions: Centre National de la Recherche Scientifique, Consiglio Nazionale delle Ricerche, Georgia Institute of Technology, Indiana University, Iowa State University, Kent State University, Michigan State University, Missippi State University, Northern Illinois University, Ohio State University, Pennsylvania State University, Purdue University, Seoul National University (RIM - GARC), Texas A&M University, University of Chicago, University of Cincinnati, University of Houston, 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, and Wayne State University.

We, and the scientists who have participated in IMA programs, are very grateful to all these agencies, corporations and universities for making IMA programming possible.

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f. Participating Institution Conferences Selected for 1999–2000

Nine IMA Participating Institution Conferences have been selected for funding during 1999–2000:

INSTITUTION	**ORGANIZERS**	**TITLE**	**DATES**
University of Houston	Garret Etgen & R. Glowinski	Differentical Equations and Their Applications	October 7–9, 1999
Ohio State University	Vitaly Bergelson, Dan Burghelea, Joe Diestel, & Paul Nevai	A Conference in Analysis	October 12–16, 1999

Texas A&M University	Goong Chen & Jianxin Zhou	A Conference on Advances in the Control of Nonlinear Distributed Parameter Systems	October 29–31, 1999
Michigan State Univ.	R. Fintushel, J. Wolfson, & Y. Raun	Great Lakes Geometry Conference	March or April 2000
University of Notre Dame	M. Alber, L. Faybusovich, F. Jarre, Gl. Misiolek, Q. Han, B. Hu, & H-M Yin	A Conference on Nonlinear Problems in Applied Mathematics	April 6–9, 2000
University of Illinois at Urbana-Champaign	B. Berndt	International Conference on Number Theory	May 21–26, 2000
University of Iowa	J.S. Chen, K.K. Choi, W. Han, S. Oliveira, D. Stewart	Meshless Methods: Theory, Computation, and Applications	May or June 2000
University of Illinios at Urbana-Champaign	Carl G. Jockusch	Symposia on The Development and Future Prospects of Logic	June 3–7, 2000
Purdue University	L. Lampert, S. K. Yeung	Midwest Several Complex Variables Meeting	October, 2000

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 three participating Institution department heads: Richard Brualdi (University of Wisconsin, Chair), Max Gunzberger (Iowa State), and Dan Maki (Indiana).

Proposals for 2000–2001 will be due on April 1, 2000.

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g. IMA Newsletter and Update Distribution via the World Wide Web

The IMA is gradually implementing internet-based programs to improve our service to you. As a result, we have changed the way we send out the Newsletter and Update. We would like to e-mail you a notice when the next IMA Newsletter or Update is available on the IMA Web page, instead of mailing you a hard copy. The updated version of either publication are available on our IMA Web Page: http://www.ima.umn.edu/newsltrs/

The IMA will continue to mail a hard copy to specific departments, for posting purposes.

If for some reason you cannot retrieve either document from the Web, please call the IMA staff at 612-624-6066 or e-mail staff@ima.umn.edu if you would like to continue to receive a hard copy of the IMA Newsletter.

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h. 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

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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

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owner-weekly@ima.umn.edu
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The current weekly schedule is also available on request via `finger seminar@ima.umn.edu`. An updated `.dvi` file of the IMA Newsletter (current and recent) is available by `ftp` or through the world-wide web.

II. IMA CALENDAR

0. HOT TOPICS PROGRAMS for 1999–2000
See http://www.ima.umn.edu/hot-topics.html

September 9–10, 1999 HOT TOPICS Workshop on **Workshop: Analysis and Modeling of Optical Devices**

September 16-17, 1999 HOT TOPICS Workshop on **Decision Making Under Uncertainty: Assessment of the Reliability of Mathematical Models**

October 22–24: HOT TOPICS Workshop on **Scaling Phenomena in Communication Networks**

August 16–18: HOT TOPICS Workshop on **Mathematical Challenges in Global Positioning Systems (GPS)**

1. REACTIVE FLOW & TRANSPORT PHENOMENA, September 1999–June 2000
See http://www.ima.umn.edu/reactive/

Fall 1999: Combustion

For details of the Fall Schedule see http://www.ima.umn.edu/reactive/#fall

Winter 2000: Natural Resources and Environment

January 15–19: Workshop on **Confinement and Remediation of Environmental Hazards**

February 9–13: Workshop on **Resource Recovery**

March 15–19: Workshop on **Air Quality Engineering**

Spring 2000: Multiscale and Transition Regimes

May 1–5: Workshop on **Dispersive Corrections to Transport Equations**

May 18–19: Tutorial on **Simulation of Transport in Transition Regimes**

May 22–26: Workshop on **Simulation of Transport in Transition Regimes**

June 5–9: Workshop on **Multiscale Models for Surface Evolution and Reacting Flows**

2. MATHEMATICS IN MULTIMEDIA, September 2000–June 2001
See http://www.ima.umn.edu/multimedia/

Fall 2000: Vision, Speech and Language

September 11-15 Short Course on **Markov processes and Markov Random Fields Information Theory, Statistical Estimation**

September 18–22 Workshop on **Mathematical Foundations of Speech Processing and Recognition**

October 11–14 Mini-symposium on **Brain Imaging**

October 16–20 Workshop on **Image Processing and Low Level Vision**

October 30–November 3 Workshop on **Mathematical Foundations of Natural Language Modeling**

November 13–17 Workshop on **Image Analysis and High Level Vision**

Winter 2001: Digital Libraries

January 17–19 Mini-symposium on **Fractals in Multimedia**

January 25–26 Tutorial on **Digital Libraries**

January 29–February 2 Workshop on **Digital Libraries - Data Modeling and Representation**

February 12–16 Workshop on **Digital Libraries - Digital Asset Management**

February 26–March 2 Workshop on **Digital Libraries - Classification, Retrieval and Visualization**

Spring 2001: Geometric Design and Computer Graphics

April 19–20 Tutorial on **Geometric Design**

April 23–27 Workshop on **Geometric Design**

May 10–11 Tutorial on **Computer Graphics**

May 14–18 Workshop on **Computer Graphics**

June 11–15 Workshop on **Haptics, Virtual Reality and Human Computer Interaction**

June 16–17 Capstone Symposium on Mathematics in Multimedia

3. MATHEMATICS IN THE GEOSCIENCES, September 2001–June 2002
See http://www.ima.umn.edu/geoscience/

Fall 2001: Dynamical Systems and Ergodic Theory

Winter 2002: Multiscale Phenomena and Renormalization

Spring 2002: Inverse Problems and Quantification of Uncertainty

4. OPTIMIZATION, September 2002–June 2003
See http://www.ima.umn.edu/optimization/

Fall 2002: Supply Chain and Logistics Optimization

Winter 2003: New Optimization Paradigms and Approaches

Spring 2003: Information Technology and Optimization

1999–2000 Annual Program:

III. REACTIVE FLOW AND TRANSPORT PHENOMENA

September 1, 1999 – August 31 2000

Organizers: John Chadam (University of Pittsburgh)
Ashwani K. Kapila (Chair) (Rensselaer Polytechnic Institute)
David Levermore (University of Arizona)
Christian Ringhofer (Arizona State University)

See also http://ww.ima.umn.edu/reactive/

Introduction:

Chemically reacting flows, and the associated transport of mass, momentum and energy, are fundamental to numerous areas of modern technology. These include the recovery, fabrication, and processing of materials; the design and operation of devices that use fossil or nuclear fuels; and the treatment and disposal of waste and toxins. Forces of economy, safety,

efficiency and a concern for the environment dictate not only that the underlying science be advanced, but also that these advances be rapidly integrated into engineering, design, manufacturing and operation. It is broadly recognized that the challenge requires an interdisciplinary response, including, in particular, the deployment of modern techniques of applied mathematics: modeling, analysis and computation.

In this year of concentration, we have elected to emphasize three topics. Two of these, namely, Combustion, and Natural Resources and Environment, can be clearly identified as areas of application. The third, Multiscale and Transition Regimes, cuts across applications, focusing instead on processes where traditional and classical transport models no longer apply. Applications include thin, microstructured films, nanometer-scale semiconductor devices, and supercooled fluids.

The year has been divided into three segments, with a total of nine workshops. In each case, we aim to bring together researchers with overlapping interests who may move in disjoint scientific circles, and expose applied mathematicians to activity in the selected area of the workshop. The overall focus will be on identifying situations where an infusion of existing mathematical technology can lead to rapid progress, as well as recognizing areas where the existing theoretical framework needs to be

FALL QUARTER (September 1–December 31, 1999): **Combustion**
See http://www.ima.umn.edu/reactive/#fall

WINTER QUARTER (January 1–March 31, 2000): **Natural Resources and Environment**

SPRING QUARTER (April 1–June 30, 2000): **Multiscale and Transition Regimes**

Winter Quarter 2000: Natural Resources and Environment

1 Workshop (January 15–19, 2000) Confinement and Remediation of Environmental Hazards

Organizers:
Richard Ewing (Texas A&M University)
A.C. Cunningham (Montana State University)
John Chadam (University of Pittsburgh)

For current information see URL: http://www.ima.umn.edu/reactive/winter/rf5.html

This workshop will focus on the mathematical problems which arise in ground water transport of contamination, and the spreading, confinement and remediation of biological, chemical and radioactive waste. Topics include the modeling of flow through fractured and porous media, including upscaling from pore size studies and estimating model sensitivities to intrinsic uncertainties. Particular emphasis will be given to the study of processes which involve the full coupling of reaction, transport and mechanical effects. Examples include breakout from chemical and radioactive waste repositories, confinement by injection of pore plugging material and bioremediation of petroleum and other wastes. We shall encourage the participation of key experimentalists in the modeling of the basic processes, especially in the upscaling and sensitivity studies. A strong component of geology will be needed to characterize domains. Numerical approaches to simulating such processes on all scales will also be addressed (e.g. heterogeneous media, adaptive gridding, hybrid schemes, lattice Boltzmann pore scale simulations). We shall seek connection to the DOE community and ask them to present a range of problems.

CONFIRMED WORKSHOP PARTICIPANTS: January 15-19, 2000 (as of 2 November 1999)

ARBOGAST, TODD	Univ. of Texas (Mathematics)	JAN 14 – 20
BALL, BILL	Johns Hopkins Univ. (Geography)	JAN 1 – MAR 31
BENSON, SALLY	Lawrence Berkeley National Lab	JAN 14 – 19
BOUWER, EDWARD	Johns Hopkins Univ. (Geography and Enviro. Eng.)	JAN 14 – 19
CELIA, MICHAEL	Princeton Univ. (Civil Engineering & Operations)	JAN 14 – FEB 12
CHADAM, JOHN	Univ. of Pittsburgh (Mathematics)	JAN 2 – MAR 31

CHEN, BENITO	Univ. of Wyoming (Mathematics)	JAN 10 – 20
CUNNINGHAM, AL	Montana State Univ. (Center Biofilm Engineering)	JAN 14 – 19
CUSHMAN, JOHN	Purdue Univ. (Applied Math)	JAN 14 – 19
DAHLE, HELGE	Univ. of Bergen (Mathematics)	JAN 13 – 20
DAWSON, CLINT	Univ. of Texas (TICAM)	JAN 14 – FEB 13
DOUGLAS, JIM	Purdue Univ. (Applied Mathematics)	JAN 14 – FEB 13
ESPEDAL, MAGNE	Univ. of Bergen (Mathematics)	JAN 14 – FEB 13
EWING, RICHARD	Texas A&M Univ.	JAN 14 – 19
FOWLER, ANDREW	Univ. of Oxford	JAN 14 – 30
GLIMM, JAMES	SUNY at Stony Brook (Applied Mathematics and Statistics)	JAN 14 – 19
GRAY, BILL	Notre Dame Univ. (Civil Engineering)	JAN 14 – 19
JORDAN, RYAN	Montana State Univ. (Center Biofilm Engineering)	JAN 14 – 19
LAZAROV, RAYTCHO	Texas A&M Univ. (Scientific Computations)	JAN 14 – FEB 13
LEVERMORE, DAVID	Univ. of Arizona (Mathematics)	JAN 24 – FEB 6
LINDQUIST, BRENT	State Univ. of New York (Applied Mathematics and Statistics)	JAN 14 – 23
MORGAN, JEFF	Texas A&M Univ. (Mathematics)	JAN 14 – FEB 13
ORTOLEVA, PETER	Indiana Univ. (Chemistry and Geology)	JAN 14 – FEB 13
PEYTON, BRENT	Washington State Univ. (Chemical Engineering)	JAN 14 – 19
REZNIKOFF, MARIA	Rensselaer Polytechnic Institute (Applied Mathematics)	JAN 14 – 19
ROBERTS, JEAN	INRIA-Rocquencour)	JAN 14 – FEB 13
TRAVIS, BRIAN	Los Alamos National Laboratory (Earth & Environmental Sciences)	JAN 14 – 19
VAN DUIJN, HANS	CWI (Center Math & Computer Science)	FEB 1 – MAR 31
WATSON, TED	Texas A&M Univ. (Chemical Engineering)	JAN 14 – 19
WEEKES, SUZANNE	Worcester Polytechnic Institute (Mathematical Science)	JAN 4 – 31
WHEELER, MARY	Univ. of Texas at Austin (Engineering)	JAN 14 – 19
XIN, JACK	Univ. of Texas at Austin (Mathematics)	JAN 2 – JUN 30
YABUSAKI, STEVE	P.O. Box 999 (Pacific Northwest National Laboratory)	JAN 14 – 19
YOTOV, IVAN	Univ. of Pittsburgh (Mathematics)	JAN 14 – 20

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2 Workshop (February 9-13, 2000) Resource Recovery

Organizers:
John Chadam (University of Pittsburgh)
Peter Ortoleva (Indiana University)
Mary Wheeler (University of Texas, Austin)

For current information see URL: http://www.ima.umn.edu/reactive/winter/rf6.html

This workshop will focus on the modeling and simulation of problems which arise in the petroleum and mining industry. Some examples include oil and gas reservoir diagenesis and dynamics, enhanced oil recovery, well formation dynamics, spacing of uranium roll front deposits, heap leaching of minerals, etc. Many problems of this sort require a careful understanding of the coupling of reaction, transport and mechanical effects. Numerical models of ”real-life” versions of these problems are quite large and quite stiff requiring the use of hybrid methods, adaptive and multigridding and of large platforms. In this workshop we shall bring together participants from academia and industry to discuss the modeling, analysis and simulation of such problems.

CONFIRMED WORKSHOP PARTICIPANTS: February 9-13, 2000 (as of 2 November 1999)

BRYANT, STEVE	Univ. of Texas (Computational Mechanics and Applied Mat)	FEB 8 – 13
CHADAM, JOHN	Univ. of Pittsburgh (Mathematics)	JAN 2 – MAR 31
DAWSON, CLINT	Univ. of Texas (TICAM)	JAN 14 – FEB 13
DOUGLAS, JIM	Purdue Univ. (Applied Mathematics)	JAN 14 – FEB 13
EDWARDS, MIKE	Stanford Univ. (Petroleum Engineering)	FEB 8 – 13
ESPEDAL, MAGNE	Univ. of Bergen (Mathematics)	JAN 14 – FEB 13
FITZGIBBON, BILL	Univ. of Houston (Mathematics)	FEB 8 – 13
JAFFRE, JEROME	INRIA-Rocquencourt	FEB 1 – 13
JENNINGS, JIM	Univ. of Texas (Bureau Economic Geology)	FEB 8 – 13

LAKE, LARRY	Univ. of Texas (Chemical & Petroleum Engineering)	FEB 8 – 13
LAZAROV, RAYTCHO	Texas A&M Univ. (Scientific Computations)	JAN 14 – FEB 13
MARCHESIN, D.	Instituto de Matematica (Brazil)	FEB 7 – 18
MINKOFF, SUE	Sandia National Laboratories	FEB 8 – 13
ORTOLEVA, PETER	Indiana Univ. (Chemistry and Geology)	JAN 14 – FEB 13
PESZYNSKA, MALGORZATA	Univ. of Texas (Computational & Applied M)	FEB 8 – 13
RIVIERE, BEATRICE	Univ. of Texas (Computational Mechanics and Applied Mat)	FEB 8 – 13
ROBERTS, JEAN	INRIA-Rocquencourt	JAN 14 – FEB 13
SHOWALTER, RALPH	Univ. of Texas at Austin (Mathematics)	FEB 8 – 13
WANG, PENG	Univ. of Texas (Petroleum & Geosys Eng)	FEB 8 – 13
WHEELER, MARY	Univ. of Texas at Austin (Engineering)	FEB 8 – 13
WHITE, CHRIS	Univ. of Texas (Bureau Economic Geology)	FEB 8 – 13
YOTOV, IVAN	Univ. of Pittsburgh (Mathematics)	FEB 6 – 13

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3 Workshop (March 15-19, 2000) Atmospheric Modeling

Organizers:
David P. (Ford Motor Company)
Gregory R. Carmichael (University of Iowa)

For current information see URL: http://www.ima.umn.edu/reactive/winter/rf7.html

This workshop will focus on the mathematical problems which arise in the management of air quality. Presently mathematical modeling is an integral part of air quality research and management programs. Present air quality models involve complex and coupled phenomena including coupled transport, chemistry, radiative, and mass transfer process. These three dimensional models pose great mathematical challenges, because they involve complex physical domains, highly stiff sets of equations, and large number of grids. In this workshop the focus will be on various aspects of air quality modeling, related to improving the computational quality and extended uses of air quality modeling, which can only be accomplished if significant advances are made in the models. Topics to be discussed include new techniques for solutions of stiff ODEs, new methods for solving the governing PDEs including multigrid and irregular grids; sensitivity analysis tools including automatic differentiation, and optimization and inverse modeling applications. Parallel computing, compiler tools, and visualization will also be discussed. The workshop will bring together experts in modeling, analysis, and numerical analysis.

CONFIRMED WORKSHOP PARTICIPANTS: March 15-19, 2000 (as of 2 November 1999)

ACKERMANN, INGMAR	Ford (Germany)	MAR 14 – 19
BARTHELMIE, REBECCA	Indiana Univ. (Geography)	MAR 14 – 19
BINKOWSKI, FRANK	Environmental Protection Agency (Air Resources Laboratory)	MAR 14 – 19
BYUN, DAEWON	EPA (Atmospheric Science Modeling)	MAR 14 – 19
CARMICHAEL, GREGORY	Univ. of Iowa (Chemical & Biochemical Engineering)	MAR 14 – 19
CHANG, JULIUS S.	Univ. at Albany (Atmospheric Sciences Research Center)	MAR 14 – 19
CHING, JASON	US Environmental Protection Agency (Atmospheric Modeling)	MAR 14 – 19
CHOCK, DAVID	Ford Motor Company (Scientific Research Labs)	MAR 14 – 19
DENNIS, ROBIN	US Environmental Protection Agency	MAR 14 – 19
DENTENER, FRANK	Utrecht Univ. (Marine and Atmospheric Re)	MAR 14 – 19
DUNKER, ALAN	General Motors Reseach & Development Cn (Chemical & Environmental Sciences Lab)	MAR 14 – 19
ELBERN, HENDRIK	Univ. of Cologne (Inst Geophysics & Meteorology (EUR)	MAR 14 – 19
GEORGOPOULOS, PANOS	Environmental & Occupational Health Sci (DECM)	MAR 14 – 19
GIUNTA, GIULIO	Istituto Univ. Navale - Napoli (Istituto di Matematica)	MAR 14 – 19
GLIMM, JAMES	SUNY at Stony Brook (Applied Mathematics and Statistics)	MAR 14 – 19
GONG, SUN-LING	ARQM, Atmospheric Environment Service	MAR 14 – 19
HANSEN, ALAN	EPRI (Environment)	MAR 14 – 19
HASS, HEINZ	Ford (Germany)	MAR 14 – 19
JACOBSON, MARK	Stanford Univ. (Civil Engineering)	MAR 14 – 19
KREIDENWEIS, SONIA	Colorado State Univ. (Atmospheric Science)	MAR 14 – 19

KUMAR, NARESH	EPRI (Model Development and Applications)	MAR 14 – 19
LEHMANN, ELFRUN	Earth Tech - ASG	MAR 15 – 19
MILFORD, JANA	Univ. of Colorado (Engineering-Mechanical)	MAR 14 – 19
MORAN, MIKE	ARQM, Atmospheric Environment Service	MAR 14 – 19
MORRIS, RALPH	ENVIRON	MAR 14 – 19
ODMAN, TALAT	Georgia Tech (Civil Engineering)	MAR 14 – 19
OLAGUER, EDUARDO	Dow Chemical Company (Health and Environmental Sciences)	MAR 14 – 19
PANDIS, SPYROS	Carnegie Mellon University	MAR 14 – 19
PLEIM, JOHN	USEPA (Atmospheric Science Modeling)	MAR 14 – 19
PRYOR, SARA	Indiana Univ. (Geography)	MAR 14 – 19
PUN, BETTY	Atmospheric and Environmental Research	MAR 14 – 19
RABITZ, HESCHEL	Princeton Univ. (Chemistry)	MAR 14 – 19
RAO, S.T.	SUNY - Albany (Earth and Atmospheric Sciences)	MAR 14 – 19
ROSSET, ROBERT	UMR CNRS/UPS (Laboratory Aerology)	MAR 14 – 19
SAN JOSE, ROBERTO	Technical University Madrid	MAR 14 – 19
SANDU, ADRIAN	Michigan Technological Univ. (Computer Science)	MAR 14 – 19
SHANKAR, UMA	North Carolina Super computing Center	MAR 14 – 19
STOCKWELL, WILLIAM	Desert Research Institute	MAR 14 – 19
TOMLIN, ALISON	Univ. of Leeds (Fuel and Energy)	MAR 14 – 19
UNO, ITSHUSHI	Kyushu University	MAR 14 – 19
VERWER, JAN	CWI (Netherlands)	MAR 14 – 19
WEXLER, ANTHONY	Univ. of Delaware (Mechanical Engineering)	MAR 14 – 19
WHEELER, MARY	Univ. of Texas at Austin (Engineering)	MAR 14 – 19
YAMARTINO, ROBERT	Sigma Research Earth Tech	MAR 14 – 19
ZHANG, YANG	Atmospheric and Environmental Reseach, Inc.	MAR 14 – 19
ZLATEV, ZAHARI	National Environmental Research Instit.(Atmospheric Environment)	MAR 14 – 19

CONFIRMED LONG-TERM WINTER 2000 PARTICIPANTS (as of 2 November 1999)

Four Weeks or More

Natural Resources and Environment

BALL BILL	Johns Hopkins University	1 Jan–31 Mar 2000
CELIA MICHAEL	Princeton University	14 Jan–12 Feb 2000
CHADAM JOHN	University of Pittsburgh	2 Jan–31 Mar 2000
DAWSON CLINT	University of Texas	14 Jan–13 Feb 2000
DOUGLAS JIM	Purdue University	14 Jan–13 Feb 2000
ESPEDAL MAGNE	University of Bergen	14 Jan–13 Feb 2000
KNABNER PETER	Universitat Erlangen	3 Feb–27 Mar 2000
LAZAROV RAYTCHO	Texas A&M University	14 Jan–13 Feb 2000
MORGAN JEFF	Texas A&M University	14 Jan–13 Feb 2000
ROBERTS JEAN	INRIA-Rocquencourt	14 Jan–13 Feb 2000
SMITH HAL	Arizona State University	1 Sep–15 May 2000
VAN DUIJN HANS	CWI(Netherlands)	1 Feb–31 Mar 2000
WEEKES SUZANNE	Worcester Polytechnic Institute	4 Jan–31 Jan 2000

Spring Quarter 2000: Multiscale and Transition Regimes

4 Workshop (May 1-5, 2000) Dispersive Corrections to Transport Equations

Organizers:
C. David Levermore (University of Arizona)
Anton Arnold (Berlin Technical University)
Naoufel Ben Abdallah(University of Toulouse)
Ken T.-R. McLaughlin (University of Arizona)

For current information see URL: http://www.ima.umn.edu/biology/spring/rf8.html

Dispersive corrections to classical and semiclassical transport equations arise from the rudimentary incorporation of quantum effects into macroscopic flow descriptions. These models play an increasing role in the study of nanometer scale electronic devices and of fluids at extremely low temperatures. Advantages of dispersively corrected transport equations over fully quantum mechanical descriptions are that they are numerically more tractable and that they allow for a more classical coupling of the quantum system to the environment.

This workshop will have two thrusts. First, it will examine the mathematical derivation of dispersive correction terms both in linear and weakly nonlinear settings using Wigner transforms and in strongly nonlinear setting using tools from integrable systems. Second, the computational issues raised by the interplay between nonlinear and dispersive effects in, for example, quantum dots and wires, nonlinear optics, and superfluids.

CONFIRMED WORKSHOP PARTICIPANTS: May 1-5, 2000 (as of 2 November 1999)

ABDALLAH, NAOUFEL BEN	Université Toulouse	APR 30 – MAY 31
ARNOLD, ANTON	Univ. des Saarlandes	APR 30 – MAY 31
BARDOS, CLAUDE	Université Paris VII	MAY 1 – 7
BLOCH, TONY	Univ. of Michigan (Mathematics)	APR 30 – MAY 5
GARDNER, CARL	Arizona State Univ. (Mathematics)	APR 30 – MAY 5
GASSER, INGO	Univ. of Hamburg (Angewandte Mathematik)	APR 30 – MAY 31
GERARD, PATRICK	Univ. of Paris-Sud (Mathematics)	APR 30 – MAY 5
GOLSE, FRANCOIS	Ecole Normale Superieure	APR 30 – MAY 31
ILLNER, REINHARD	Univ. of Victoria (Mathematics & Statistics)	APR 30 – MAY 5
JUNGEL, ANSGAR	Technische Univ. Berlin (Fachbereich Mathematik)	APR 30 – MAY 31
LEVERMORE, DAVID	Univ. of Arizona (Mathematics)	APR 1 – JUN 30
LIU, TAI-PING	Stanford Univ. (Mathematics)	APR 30 – MAY 5
MARKOWICH, PETER	Univ. of Vienna (Mathematics)	APR 30 – MAY 31
MAUSER, NORBERT	Vienna Univ. (Inst. Mathematik, Univ. Wien)	APR 30 – MAY 5
MCLAUGHLIN, DAVID	New York University-Courant Institute	APR 30 – MAY 31
MOLONEY, JERRY	Univ. of Arizona (Mathematics)	APR 30 – MAY 5
PIETRA, PAULA	Instituto di Analisi Numerica del CNR	APR 30 – MAY 9
POUPAUD, FREDERIC	Univ. de Nice Sophia-Antipolis	APR 30 – MAY 31
SMITH, KENT	Lucent Technologies, Bell Laboratories	APR 30 – MAY 5

5 Workshop (May 22-26, 2000) Simulation of Transport in Transition Regimes

Organizers:
Irene Gamba (University of Texas, Austin)
P. Roe (University of Michigan)
Robert Glassey (Indiana University)

For current information see URL: http://www.ima.umn.edu/biology/spring/rf9.html

Technology is increasingly advancing into regimes in which particle mean-free paths are comparable to the length scales of interest, and where traditional transport models therefore break down. For example, drift-diffusion models of electron-hole transport break down for submicron semiconductors because the scale of interest are very small, while Navier-Stokes

approximations of fluid dynamics break down in outer planetary atmospheres or space shuttle reentry problem, where the mean free path are very large. Such situations can be described by particle simulations but the cost of carrying these out is much greater than that of small mean-free path models, often becoming prohibitive when one is near small mean-free path regimes. This makes the simulation of problems in which transition regimes coexist with small mean-free path regimes particularly difficult. This difficulty is compounded when the geometry is complicated or even random.

This workshop will explore a variety of advanced models such us moment based models, Chapmann-Enskog and Burnett type expansions, or models derived from asymptotic limits. These models, both deterministic and stochastic in origin, will be studied in the context of the simulation of high-altitude flight, charged particles in natural plasmas, man-made plasmas (electric propulsion for satellites), electron and holes in semiconductor devices, and radiation through inhomogeneous media. Hybrid numerical schemes that properly match transition with small mean-free path regimes will also be examined.

CONFIRMED WORKSHOP PARTICIPANTS: May 22-26, 2000 (as of 2 November 1999)

ABDALLAH, NAOUFEL BEN	University Toulouse	APR 30 – MAY 31
AGARWAL, RAMESH	Wichita State Univ. (Aerospace Engineering)	MAY 21 – 26
ANILE, ANGELO M.	Univ. di Catania (Mathematics)	MAY 1 – 31
BARDOS, CLAUDE	University Paris VII	MAY 22 – 26
BORGERS, CHRISTOPH	Tufts Univ. (Mathematics)	MAY 21 – 26
CARRILLO, JOSE	Univ. of Texas at Austin (Mathematics/C1200)	MAY 14 – 26
CHARRIER, PIERRE	Univ. Bordeaux I (Mathematiques Appliques)	MAY 21 – 26
EU, B.C.	McGill Univ. (Chemistry)	MAY 21 – 26
FISCHETTI, MAX	IBM (Research)	MAY 21 – 26
GAMBA, IRENE	Univ. of Texas at Austin (Mathematics)	APR 1 – MAY 31
GOLSE, FRANCOIS	Ecole Normale Superieure	APR 30 – MAY 31
GOUDON, THIERRY	Univ. Nice Sophia Antipolis	MAY 1 – 31
GROTH, CLINTON	Univ. of Toronto (Aerospace Studies)	MAY 21 – 26
HITTINGER, JEFFREY	Univ. of Michigan (Aerospace Engineering)	MAY 21 – 26
ILLNER, REINHARD	Univ. of Victoria (Mathematics & Statistics)	MAY 21 – 26
JEROME, JOSEPH	Northwestern Univ. (Mathematics)	MAY 21 – 26
JIN, SHI	Georgia Tech (Mathematics)	MAY 21 – 26
JUNGEL, ANSGAR	Technische Univ. Berlin (Fachbereich Mathematik)	APR 30 – MAY 31
JUNK, MICHAEL	Univ. of Kaiserslautern (Fachbereich Mathematik)	MAY 21 – 26
KLAR, AXEL	Univ. of Kaiserslautern (Fachbereich Mathematik)	MAY 20 – 28
MARKOWICH, PETER	Univ. of Vienna (Mathematics)	APR 30 – MAY 31
MUSCATO, ORAZIO	Univ. di Catania (Dipartimento di Matematica)	MAY 21 – 26
PERTHAME, BENOIT	Ecole Normale Superieure ()	MAY 21 – 26
POUPAUD, FREDERIC	Univ. de Nice Sophia-Antipolis	APR 30 – MAY 31
RUDAN, MASSIMO	Univ. di Bologna (DEIS)	MAY 21 – 26
RYZHIK, LENYA	Univ. of Chicago (Mathematics)	MAY 21 – 26
SARANITI, MARCO	Illinois Institute of Technology (Electrical & Computer Engineer)	MAY 21 – 26
SCHAEFFER, JACK	Carnegie Mellon University	MAY 21 – 26
SCHMEISER, CHRISTIAN	TU Wien (fuer Angewandte und Numerische)	MAY 1 – 31
SLEMROD, MARSHALL	Univ. of Wisconsin (Mathematics)	MAY 1 – 31
SOLER, JUAN	Univ. of Granada (Aplicada)	MAY 21 – 26
STRAUSS, WALTER A.	Brown Univ. (Mathematics)	MAY 21 – 26
STRUCKMEIER, JENS	Univ. of Hamburg (Mathematics)	MAY 21 – 26
VILLANI, CEDRIC	ENS, DMI	MAY 21 – 26
XIN, ZOUPING	NYU-Courant	MAY 21 – 26
XU, KUN	Hong Kong Univ. (Mathematics)	MAY 21 – 26

6 Workshop (June 5-9, 2000) Multiscale Models for Surface Evolution and Reacting Flows

Organizers:
Leonard Borucki (Motorola)
Christian Ringhofer (Arizona State University)

For current information see URL: http://www.ima.umn.edu/biology/spring/rf10.html

Multilayered compound materials with microscopically structured surfaces play a key role in semiconductor manufacturing. These structures are produced by a variety of processes, such as the deposition of thin films, etching techniques and controlled crystal growth.

The topic of this workshop is the integration of different models describing these processes on different spatial and temporal scales. Well-developed models exist for each stage of the above processes on the microscopic-atomistic and macroscopic-fluid scale. However, in order to describe completely the whole process, it is necessary to link these models via an appropriate mathematical description of the transition regimes. This involves a mixture of boundary layer and homogenization techniques as well as a mathematical analysis of the transition process from the atomistic description of the early stages of thin film growth to the evolution of continuous films. Computational issues covered by this workshop will be the deterministic and probabilistic representation of film surfaces and numerical methods for the transitional models.

CONFIRMED WORKSHOP PARTICIPANTS: June 5-9, 2000 (as of 2 November 1999)

BOON, JEAN-PIERRE	Univ. Libre de Bruxelles ()	JUN 4 – 9
BORUCKI, LEN	Motorola	JUN 4 – 9
CALE, TIMOTHY S.	Rensselaer Polytechnic Institute (Chemical Engineering)	JUN 4 – 9
DEMKOV, ALEX	Motorola	JUN 4 – 9
FRIEDMAN, AVNER	Univ. of Minnesota (MCIM)	SEP 1 – AUG 31
GHONIEM, NASR M.	UCLA (Engineering)	JUN 4 – 9
GOBBERT, MATTHIAS	Univ. of Maryland (Mathematics & Statistics)	JUN 1 – 30
HUANG, HANCHEN	Hong Kong Polytechnic Univ. (Mechanical Engineering)	JUN 4 – 9
KAPRAL, RAY	Univ. of Toronto (Chemistry)	JUN 4 – 9
KATSOULAKIS, MARKOS A.	Univ. of Massachusetts (Mathematics and Statistics)	JUN 4 – 9
KING, JOHN	Univ. of Nottingham (Theoretical Mechanics)	JUN 1 – 30
LEVERMORE, DAVID	Univ. of Arizona (Mathematics)	APR 1 – JUN 30
MEYYAPPAN, MEYYA	NASA Ames Research Center	JUN 4 – 9
OSHER, STANLEY	UCLA (Mathematics)	JUN 1 – 30
RATSCH, CHRISTIAN	UCLA (Mathematics)	JUN 1 – 30
REITICH, FERNANDO	Univ. of Minnesota (Mathematics)	JUN 4 – 9
RINGHOFER, CHRISTIAN	Arizona State Univ. (Mathematics)	APR 1 – JUN 30
SETHIAN, JAMES	Univ. of California-Berkeley (Mathematics)	JUN 4 – 9
VLACHOS, DION G.	Univ. of Massachusetts (Chemical Engineering)	JUN 4 – 9
WALKER, ROBERT B.	Los Alamos National Laboratory (Theoretical Chemistry)	JUN 4 – 9

CONFIRMED LONG-TERM SPRING 2000 PARTICIPANTS (as of 2 November 1999)

Four Weeks or More

Multiscale and Transition Regimes

ABDALLAH, NAOUFEL BEN	University of Toulouse	30-Apr – 31-May 2000
ANILE, ANGELO M.	Universita di Catania	1-May – 31-May 2000
ARNOLD, ANTON	Universitat des Saarlandes	30-Apr – 31-May 2000
GAMBA, IRENE	University of Texas at Austin	1-Apr – 31-May 2000

GASSER, INGO	University of Hamburg	30-Apr – 31-May 2000
GOBBERT, MATTHIAS	University of Maryland	1-Jun – 30-Jun 2000
GOLSE, FRANCOIS	Ecole Normale Superieure	30-Apr – 31-May 2000
GOUDON, THIERRY	Universite Nice Sophia Antipolis	1-May – 31-May 2000
JUNGEL, ANSGAR	Technische Universitat Berlin	30-Apr – 31-May 2000
KING, JOHN	University of Nottingham	1-Jun – 30-Jun 2000
LEVERMORE, DAVID	University of Arizona	1-Apr – 30-Jun 2000
MARKOWICH, PETER	University of Vienna	30-Apr – 31-May 2000
MCLAUGHLIN, DAVID	New York University-Courant Institute	30-Apr – 31-May 2000
OSHER, STANLEY	UCLA	1-Jun – 30-Jun 2000
POUPAUD, FREDERIC	Universite de Nice Sophia-Antipolis	30-Apr – 31-May 2000
RATSCH, CHRISTIAN	UCLA	1-Jun – 30-Jun 2000
RINGHOFER, CHRISTIAN	Arizona State University	1-Apr – 30-Jun 2000
SCHMEISER, CHRISTIAN	Inst. Angewandte und Numerische Mathematik	1-May – 31-May 2000
SLEMROD, MARSHALL	University of Wisconsin	1-May – 31-May 2000

III. Summer 2000 Programs

July 19–28, 2000 Mathematical Modeling in Industry - A Workshop for Graduate Students
August 16–18, 2000 Mathematical Challenges in Global Positioning Systems (GPS)

Summer Program (July 19–28, 2000) Mathematical Modeling in Industry - A Workshop for Graduate Students

Organizers:
Rachel Kuske (University of Minnesota)
Fernando Reitich (University of Minnesota)

For current information see URL: http://www.ima.umn.edu/biology/winter/modeling/
This workshop is designed to provide graduate students and qualified advanced undergraduates with first hand experience in industrial research.

Format: Students will work in teams of up to 6 students under the guidance of a tutor from industry. The tutor will help guide the students in the modeling process, analysis and computational work associated with a real-world industrial problem. Each team will be expected to make a public oral presentation and submit a written report at the end of the 10-day period.

Projects and Industry Mentors: There will be 6 teams participating in the workshop. The following industry scientists have agreed to participate as mentors:

Participant	**Affiliation**	**Tentative Topic**
Dr. Robert Melville	Lucent Technologies	RF Communication Circuits
Dr. Joan Bachenko	Linguistic Technologies	Speech Recognition
Dr. Thomas Grandine	Boeing	Computer Aided Design
Dr. Sarah Patch	General Electric	Computer Tomography
Dr. Norm Curet	National Security Agency	Network Analysis
Dr. David Ross	Eastman Kodak	Mirror Polishing/InkJet Printing

Application Procedure: Graduate students and advanced undergraduates are invited to apply. An application form must be submitted to the IMA. In addition, two letters of recommendation are required; one must be from the student's advisor,

director of graduate studies, or department chair. Prerequisites vary and depend on the project, but computational skills are important.

The IMA will cover local living expenses but not travel (IMA Participating Institution may use their PI funds for this purpose). Selection criteria will be based on background and statement of interest, as well as geographic and institutional diversity. Women and minorities are especially encouraged to apply. **Applications must be completed by April 15, 2000** for full consideration. Early submissions are encouraged. Successful applicants will be notified by May 10, 2000.

A similar modeling course was held at the IMA during summer 1998. The industrial problems and student reports are available online. For further information contact `ima-staff@ima.umn.edu` or see on the web
URL: http://www.ima.umn.edu/modeling/

HOT TOPICS Workshop (August 16–18, 2000) Mathematical Challenges in Global Positioning Systems (GPS)

Organizers:
Kai Borre (Aalborg Universitet)
Gerard Lachapelle (University of Calgary)
Brian Leininger (Lockheed Martin)
Fan Liu (Honeywell)

For current information see URL: http://www.ima.umn.edu/gps/

The Global Positioning System (GPS) utilizes triangulation and/or phase delays in continuous signals from a constellation of satellites in earth orbit to accurately locate a receiver antenna position relative to these satellites. GPS plays an important role in many navigation systems produced today, and is beginning to play an increasing role in providing accurate time signals for many industries. Applications include land surveying, autonomous vehicle control including the smart highway system, marine navigation, air traffic control, satellite navigation, and power signal time synchronization. With the addition of differential or relative signals, ultra-high precision GPS is capable of position accuracies on the order of a few centimeters.

There is a need for sophisticated algorithms for accurately and reliably processing the GPS signals for timing and navigation. Mathematics is of critical importance here. Areas of mathematics that are relevant include linear and non-linear algebra, signal processing and filtering, wave propagation, statistics, and scattering.

This workshop will focus on mathematical issues that arise in increasing the processing speed, accuracy and reliability of GPS. It will be an opportunity for the mathematical community to become more aware of these issues. Invited participants will be mathematicians, engineers and scientists from industry and from academia.

Among the principal topics considered will be:

- Problems with reflected signals (Multipath) with respect to pseudo-range data and integrated carrier data, their mathematical characterization and methods of addressing these problems
- Integrity of solutions of positioning algorithms
- Resolution of the phase ambiguity in position determination
- Global tomography, estimation of water content in the troposphere and the ionosphere

Additional topics: Antennas (beam pattern characterization and utilization, antenna shaping), Mathematical modeling of the GPS receiver, Avoidance of frequency jamming and/or interference, Use of dual and triple frequencies from GPS, GLONASS.

IV. THE IMA VOLUMES IN MATHEMATICS AND ITS APPLICATIONS

The IMA Volumes listed here except for Volume 115 are currently in Springer-Verlag's production queue. To check if a particular volume has been released or if you want to purchase the volume on line visit the IMA web page.

http://www.ima.umn.edu/volumes.html

You can also place an order for available volumes by calling the toll-free # 1–800–SPRINGER or by writing:
attn: Book Fulfillment Department
Springer-Verlag
44 Hartz Way
Secaucus, NJ 07094

Volume 115: Pattern Formation in Continuous and Coupled Systems: A Survey Volume
Editors: Martin Golubitsky, Dan Luss, and Steven H. Strogatz

This volume contains a number of mini-review articles authored by speakers and attendees at the IMA workshop on *Pattern Formation in Continuous and Coupled Systems.* Pattern formation has been studied intensively for most of this century by both experimentalists and theoreticians. This workshop focused on new directions in the patterns literature. Systems that generate new types of pattern such as discrete coupled systems, systems with global coupling, and combustion experiments were stressed, as were new types of pattern.

The mini-reviews in this volume are intended to be pointers to the current literature for researchers at all levels and to have extensive bibliographies. They are also intended to discuss why certain subjects are currently exciting and worthy of additional research.

Volume 116: Statistical Models in Epidemiology, the Environment and Clinical Trials
Editors: M. Elizabeth Halloran and Donald Berry

This volume contains refereed papers by participants in the two weeks on Clinical Trials and one week on Epidemiology and the Environment held as part of the six weeks workshop on Statistics in the Health Sciences at the Institute for Mathematics and its Application (IMA) in the summer 1997. Donald Berry was in charge of the weeks on clinical trials, and Elizabeth Halloran organized the week on epidemiology and the environment. The collection includes a major contribution from Jamie Robins, Andrea Rotnitzky, and Daniel Scharfstein on sensitivity analysis for selection bias and unmeasured confounding in missing data and causal inference models. In another paper, Jamie Robins presents a new class of causal models called marginal structural models. Alan Hubbard, Mark van der Laan, and Jamie Robins present a methodology for consistent and efficient estimation of treatment-specific survival functions in observational settings. Brian Leroux, Xingye Lei, and Norman Breslow present a new mixed model for spatial dependence for estimating disease rates in small areas. Andrew Lawson and Allan Clark demonstrate Markov Chain Monte Carlo methods for clustering in spatial epidemiology. Colin Chen, David Chock, and Sandra Winkler present a simulation study examining confounding in estimation of the epidemiologic effect of air pollution. Dalene Stangl discusses issues in the use of reference priors and Bayes factors in analyzing clinical trials. Stephen George reviews the role of surrogate endpoints in cancer clinical trials.

Volume 117: Structured Adaptive Mesh Refinement (SAMR) Grid Methods
Editors: Scott B. Baden, Nikos P. Chrisochoides, Dennis B. Gannon, and Michael L. Norman

This volume contains papers from a workshop on Structured Adaptive Mesh Refinement (SAMR) held by the Institute of Mathematics and its Applications in the Spring of 1997.

Structured adaptive mesh refinement (SAMR) methods have matured over the past 20 years and are now the method of choice for certain difficult problems, such as compressible flow. SAMR presents difficult technical challenges, both in

terms of the numerical techniques involved and the complexity of the programming effort, especially on parallel computers. In order to gain insight into managing these difficulties, much research effort has been directed at mesh generation, parallel computation, and improvements in accuracy, aimed primarily at refinement interfaces. A major stumbling block in this endeavor is that many of these techniques entail substantial amounts of problem specific detail. Standardization is highly unlikely, except within narrowly defined problem domains.

The papers presented in this collection are based on talks given at the Workshop on Structured Adaptive Mesh Refinement Grid Methods, held at the Institute for Mathematics and Its Applications, University of Minnesota, on March 12-13, 1997. They describe research to improve the general understanding of the application of SAMR to practical problems; identify issues critical to efficient and effective implementation on high performance computers; stimulate the development of a community code repository for software including benchmarks to assist in the evaluation of software and compiler technologies. The ten Chapters of this volume have been divided into two parts reflecting two major issues in the topic: (I) programming complexity of SAMR algorithms and (II) applicability and numerical challenges of SAMR methods. Part I presents three programming environments and two libraries that address the concerns of efficient execution and reduced software development times of SAMR applications. Part II describes an overview of applications that can benefit from SAMR methods, ranging from crack propagation and industrial boilers to the evolution of a cluster of galaxies.

Volume 118: Dynamics of Algorithms
Editors: Rafael de la Llave, Linda R. Petzold, and Jens Lorenz

The articles collected in this volume represent the contributions presented at the IMA workshop on "Dynamics of Algorithms" which took place in November 1997. The workshop was an integral part of the 1997–98 IMA program on "Emerging Applications of Dynamical Systems."

The interaction between algorithms and dynamical systems is mutually beneficial since dynamical methods can be used to study algorithms that are applied repeatedly. Convergence, asymptotic rates are indeed dynamical properties. On the other hand, the study of dynamical systems benefits enormously from having efficient algorithms to compute dynamical objects.

Volume 119: Numerical Methods for Bifurcation Problems and Large-Scale Dynamical Systems
Editors: Eusebius Doedel and Laurette S. Tuckerman

The Institute for Mathematics and its Applications (IMA) devoted its 1997–1998 program to Emerging Applications of Dynamical Systems. Dynamical systems theory and related numerical algorithms provide powerful tools for studying the solution behavior of differential equations and mappings. In the past 25 years computational methods have been developed for calculating fixed points, limit cycles, and bifurcation points. A remaining challenge is to develop robust methods for calculating more complicated objects, such as higher-codimension bifurcations of fixed points, periodic orbits, and connecting orbits, as well as the calculation of invariant manifolds. Another challenge is to extend the applicability of algorithms to the very large systems that result from discretizing partial differential equations. Even the calculation of steady states and their linear stability can be prohibitively expensive for large systems (e.g. $10^3 - -10^6$ equations) if attempted by simple direct methods.

Several of the papers in this volume treat computational methods for low and high dimensional systems and, in some cases, their incorporation into software packages. A few papers treat fundamental theoretical problems, including smooth factorization of matrices, self–organized criticality, and unfolding of singular heteroclinic cycles. Other papers treat applications of dynamical systems computations in various scientific fields, such as biology, chemical engineering, fluid mechanics, and mechanical engineering.

Volume 120: Parallel Solution of Partial Differential Equations
Editors: Petter Bjørstad and Mitchell Luskin

The papers in this volume are based on lectures given at the IMA workshop on the Parallel Solution of PDE during June 9–13, 1997. The numerical solution of partial differential equations has been of major importance to the development of many technologies and has been the target of much of the development of parallel computer hardware and software. Parallel computer offers the promise of greatly increased performance and the routine calculation of previously intractable problems.

This volume contains papers on the development and assessment of new approximation and solution techniques that can take advantage of parallel computers. It will be of interest to applied mathematicians, computer scientists, and engineers

concerned with investigating the state-of-the-art and future directions in numerical computing. Topics include domain decomposition methods, parallel multi-grid methods, front tracking methods, sparse matrix techniques, adaptive methods, fictitious domain methods, and novel time and space discretizations. Applications discussed include fluid dynamics, radiative transfer, solid mechanics, and semiconductor simulation.

Forthcoming Volumes:

1996–1997: *Mathematics in High Performance Computing*

Parallel Solution of Partial Differential Equations

1997–1998: Emerging Applications of Dynamical Systems

Multiple-Time-Scale Dynamical Systems

1998–1999: Mathematics in Biology

Pattern Formation and Morphogenesis

Endocrinology: Mechanism of Hormone Secretion and Control

Membrane Transport and Renal Physiology

Mathematical Approaches for Emerging and Reemerging Infectious Diseases

1999 Summer Program: Codes, Systems, and Graphical Models