INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS

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IMA UPDATE

winter 1999

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

CONTENTS

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, 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, Wayne State University.

PARTICIPATING CORPORATIONS: Bellcore, Eastman Kodak, EPRI, Ford, General Motors, Honeywell, IBM, Lockheed Martin, Lucent Technologies, Medtronic, Motorola, Siemens, 3M.

Version of December 20, 1998

I. NEWS AND NOTES

a.New Members Elected to the Board of Governors

At annual meeting in Minneapolis on 8 November 1998, 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, 1999. They are **Douglas Arnold** of Pennsylvania State University, **Richard Karp** of the University of Washington, **Thomas Magnanti** of the Massachusetts Institute of Technology, and **Juan Meza** of Sandia National Laboratory.

Retiring members are David H. Bailey (NERSC), William Pulleyblank (IBM T. J. Watson Res. Ctr.), Al Taylor (University of Michigan), and James Turner (Arizona State University). The IMA would like to express its deep gratitude to Drs. Bailey, Pulleyblank, Taylor and Turner for their ideas and dedication in serving on the Board during the past three years. Continuing Board members are Lynne Billard (University of Georgia), Robert Calderbank (AT&T Bell Labs), Rosemary Chang (Silicon Graphics), Jennifer Chayes (Microsoft), James Paul Keener (University of Utah), John Polking (Rice University), Paul H. Rabinowitz (Univ. of Wisc.-Madison), and Ridgway Scott (University of Houston)

b. 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:

E-mail: miller@ima.umn.edu
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Minneapolis, Minnesota 55455
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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.

c. Medtronic Joins IMA as Participating Corporation

Medtronic (see www.medtronic.com) has recently joined the IMA as a Participating Corporation. The IMA Participating Corporation program aims at broadening relations between university and industry mathematical scientists and identifying new mathematical research areas of interest to industry.

d. PI Conference: "Nonlinear Partial Differential Equations" April 1–4, 1999 at the University of Iowa

Location and Date:

University of Iowa, Iowa City, Iowa on April 1-April 4, 1999.

Organizing committee: H. Hethcote, T. Li, Y. Li, G. Strohmer, L. Wang(lwang@math.uiowa.edu) and S. Wu.

Scientific Program

The aim of this conference is to bring together mathematicians with interests in nonlinear partial differential equations and their applications to other areas in mathematics and related fields in the sciences. There have been a lot of advances and better understandings of partial differential equations recently. At the same time, the applications of partial differential equations to various sciences have been booming. This conference will present these developments and explore new connections.

The Focus

(a) Geometric Aspects of Elliptic Equations. Dynamical Problems of Elliptic Equations. Free boundary Problems. Motion of Surfaces by its Curvatures.

(b) Hyperbolic Problems. Conservations Laws. Fluids. Wave Equations and equations from mathematical physics. Equations with parameters, such as Ginzburg Laudau Problems.

(c) New Problems from Applied Sciences. Modeling Physical Phenomena with PDEs.

The Meeting

We expect 100 mathematicians to attend the conference. Rooms and attendees will be at the Iowa House in the Iowa Memorial Union where the talks will take place. The invited talks will be 40 minutes with 20 minute breaks. There will also be 20 minute contributed talks. The Program We plan to invite 20 speakers, a preliminary list includes,

I. Anthanaopoulos, (Greece)	P. Bauman	Bresson (Italy)
L. Caffarelli	B. Chow	A. Cordoba, (Spain)
W. E	L. Evans	A. Friedman
I. Gamba	M. Grillakis	C. Gutierrez
R. Jerrard	R. Hamilton	D. Hoff
C. Kenig	H. Koch	C. Li
F-H. Lin	T-P. Liu	S. Luckhaus,(Germany)
F. Merle(Paris)	W-M. Ni	S. Salsa (Italy)
L. Simon	C. Sogge	J. Spruck
V. Sverak	E. Tadmor	T. Tao
T. Wolff	Tahvildar-Zadeh	D. Tataru
Z-P Xin	Y. Zheng	Y. Zhou (China)

e. PI Conference: "Nonlinear Partial Differential Equations and Applications to Materials" April 30–May 2 1999, at the University of Minnesota

For further information and registration, see `http://www.ima.umn.edu/~gulliver/confs/pdemat.html`.

This conference will bring together researchers in materials science, applications of PDEs, analysis of PDEs and numerics in a setting which will allow informal interaction as well as a selection of talks by leaders in the respective fields.

In this manner, issues of intense interest in materials science will be brought to the attention of modelers, theoretical analysts and numerical analysts for discussion with the expectation that they will provide ideas and insight useful for the challenges offered by materials research. At the same time, new concepts and methods currently being brought to bear on the fundamental issues in the analysis of PDEs (numerical and theoretical) will be presented in a way which may open new paths of inquiry for modelers and for materials scientists.

Topics which will be discussed include level-set methods, viscosity solutions of scalar PDEs and of systems, nonlinear homogenization, multiple time scales, widely varying length scales, fast numerical methods, and mesoscale models derived from microscale with their relations with the macroscale viewpoint.

Confirmed Speakers:

Oscar Bruno (Cal Tech)	Graeme Milton (Utah)
Avner Friedman (Minnesota)	George Papanicolaou (Stanford)
Richard James (Minnesota)	Michael Ortiz (Cal Tech)
Robert Kohn (Courant Institute)	Stanley Osher (UCLA)
John Lowengrub (Minnesota)	Mete Soner (Carnegie-Mellon/Princeton)
Mitchell Luskin (Minnesota)	Vladimir Šverák (Minnesota)
Geoff McFadden (NIST)	

Financial Support

Support is available for graduate students; the application deadline is February 5, 1999. Requests for support for faculty from Participating Institutions should be made to the Participating Institution's Math Department chair.

See also the enclosed flyer.

f. PI Conference: "Great Plains Operator Theory Symposium" May 26–30, 1999 at Iowa State University

Introduction

The Great Plains Operator Theory Symposium (GPOTS) began as a regional conference at the University of Kansas in May, 1981. In May, 1984 it was held at Iowa State, with an attendance of about 50 mathematicians. In the intervening years, the conference has grown, and now it is the largest conference in the area of operator theory/operator algebras in the world. In recent years attendance has fluctuated around 100. In May, 1995 it was held at the University of Cincinnati, and May, 1996 at Arizona State University. Last year (1997), when it was held at Queens University in Kingston, Ontario, attendance was over 125, but that was held in conjunction with the Canadian Operator Theory Symposium. Last May (1998) it was held at Kansas State University. Other institutions that have hosted GPOTS include Texas A&M, University of Houston, University of Colorado, University of Iowa, University of Nebraska and University of New Mexico.

Participants include not only U.S. and Canadian mathematicians, but also some from Europe, Japan and Australia.

The structure of the conference will be as follows: the conference will last $4\frac{1}{2}$ days: each day there will be two plenary speakers and two or three parallel sessions of talks running for 25 minutes. The evening before the first day there will be a reception, and toward the end a conference banquet. It has also been customary to have some kind of conference excursion, and the middle day of the conference we plan to end the formal talks at noon, and take the participants to Boone for a ride on the Scenic Valley.

The conference is not focused on a single theme, but encompasses a wide spectrum of operator theory and operator algebras, including applications. Thus, we have invited plenary speakers working in Von Neumann algebras, classification of C*-algebras, nonsefladjoint algebras (including groupoid theory, inductive limit algebras), applications to statistics and electrical engineering.

GPOTS is an opportunity for graduate students who are nearing completion and for young postdocs to talk about their work, and to meet with and interact with more established researchers.

List of principal Principal Speakers

The following principal speakers have been confirmed:
William Arveson, (University of California, Berkeley): In the thirty years he has been at Berkeley, he has had a major influence on operator algebras. Recent work concerns endomorphisms of operator algebras.
Man-Duen Choi, (University of Toronto): Choi has been involved in many developments in operator algebras over the years.
Yuri Latushkin, (University of Missouri, Physics):
Baruch Solel, (Technion–Israel Institute of Technology): Solel has had a collaboration with Paul Muhly (U. of Iowa) over the past decade exploiting the theory of groupoids in their study of nonselfadjoint operator algebras.
Huaxin Lin, (University of Oregon): Has worked in C*-algebras, including real-rank zero.
Stephen Power, (University of Lancaster, U.K.): He has been a frequent visitor to the U.S. and speaker at conferences over the years. His research in inductive limit algebras has had a formative influence on the development of the subject.
V. S. Sunder, (Institute of Mathematical Sciences, Madras, India): He has coauthored a book with Halmos, and has another book on VonNeumann algebras. In addition he has been active in von Neumann algebras.

Funding

GPOTS '99 at Iowa State University is being supported by:
The National Science Foundation
The IMA
The Departments of Mathematics, Statistics and Electrical Engineering at Iowa State
Miller Lecture Funds from the College of Liberal Arts and Sciences at Iowa State
Professor Wolfgang Kliemann of the Department of Mathematics at Iowa State

Organizers

There is a GPOTS steering committee which meets each year during the conference to decide on the location of future conferences. Usually, these decisions are made three years in advance of the conference. The steering committee consists of representatives of universities which have held GPOTS in one of the past several years as well as representatives of institutions which would like to host the conference in the future. Universities in the midwest, where GPOTS originated, are prominent on the steering committee.

There are three of us at Iowa State responsible for the organization:
Justin R. Peters
Yiu Tung Poon
Bruce H. Wagner
e-mail: gpotsiastate.edu URL: `http://www.math.iastate.edu/`

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
```

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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

April 24–27, 1999 HOT TOPICS Workshop on **Challenges and Opportunities in Genomics: Production, Storage, Mining and Use**

July 20–24, 1999 HOT TOPICS Workshop on **Decision Making under Uncertainty: Energy and Environmental Models**

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

1. MATHEMATICS IN BIOLOGY, September 1998–June 1999

Fall 1998: Theoretical Problems in Developmental Biology and Immunology

For the Fall schedule, see the Winter 1998 update or URL: http:/www.ima.umn.edu/biology/index.html#fall

Winter 1999: Mathematical Problems in Physiology

For the Winter schedule, see the Fall 1998 update or URL: http:/www.ima.umn.edu/biology/index.html#winter

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 Epidemiology & Immunology**

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

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

2. CODES, SYSTEMS and GRAPHICAL MODELS, August 2–13 1999

August 2–6: Week 1 on **Codes on Graphs and Iterative Decoding**

August 9–13: Week 2 on **Connections Among Coding Theory, System Theory and Symbolic Dynamics**

3. REACTIVE FLOW & TRANSPORT PHENOMENA, September 1999–June 2000

Fall 1999: Combustion

September 23–24: Tutorial on **Low-speed Combustion**

September 27–October 1: Workshop on **Low-speed Combustion**

October 11–13: Workshop on **Fires**

October 14–15: Minisymposium on **Mathematical and Computational Strategies for Simplifying Complex Kinetics**

November 5: Tutorial on **High-speed Combustion**

November 8–12: Workshop on **High-speed Combustion in Gaseous and Condensed-phase Energetic Materials**

Winter 2000: Natural Resources and Environment

January 26–30: 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**

4. MATHEMATICS IN MULTIMEDIA, September 2000–June 2001

Fall 2000: Vision, Speech and Language

Winter 2001: Compression, Communication and Retrieval

Spring 2001: Geometric Design and Computer Graphics

5. MATHEMATICS IN THE GEOSCIENCES, September 2001–June 2002

Fall 2001: Dynamical Systems and Ergodic Theory

Winter 2002: Multiscale Phenomena and Renormaization

Spring 2003: Inverse Problems and Quantification of Uncertainty

Summer Program:

III. CODES, SYSTEMS and GRAPHICAL MODELS

August 2–13, 1999

Organizers: G. David Forney, Motorola
Brian Marcus, IBM Almaden Research Center
Joachim Rosenthal, University Notre Dame
Alexander Vardy, University of Illinois

The invention of turbo codes and other capacity-approaching codes has led to an exciting cross-fertilization of ideas between researchers from different backgrounds.

The aim of the workshop is to bring together mathematicians, computer scientists, and electrical engineers in the area of coding theory, systems theory and symbolic dynamics so that the techniques from one area can be applied to problems in the other area. The two weeks of the workshop will be subdivided into two main focus areas:

August 2–6: Week 1 on **Codes on Graphs and Iterative Decoding**

Belief propagation in Bayesian networks has been extensively studied in artificial intelligence since the work of Pearl a decade ago, and turbo codes have recently become a subject of much research in coding theory. In the past year or two it has been recognized that the iterative decoding algorithm used for turbo codes and other capacity-approaching schemes is an instance of belief propagation. This has led to an explosion of work devoted to understanding and exploiting this connection. A related problem is that of representing a given code by a graph, such as a Bayesian network. A central impetus of much of this work is to understand why iterative algorithms work so well empirically on graphs with cycles, where practically no theoretical results are known. Experts in the dynamics of algorithms have also begun to be drawn into this work. The major focus of week 1 of the IMA workshop will be to bring together researchers in these various fields to better understand these emerging connections. This will be a natural follow-on to a special session on this subject at the upcoming 1998 MTNS conference (Mathematical Theory of Networks and Systems, among the most mathematical of the systems theory conferences).

Topics for week 1 include: Codes defined on graphs, iterative decoding algorithms, factor graphs, turbo codes, connections with Bayesian networks.

August 9–13: Week 2 on **Connections Among Coding Theory, System Theory and Symbolic Dynamics**

Coding Theory, System Theory and Symbolic Dynamics have much in common as evidenced by the following list of research topics that play a prominent role in each:

1. Construction of various types of finite- and finite-dimensional state representations of sequence spaces.
2. Investigation of fundamental structural properties of sequence spaces, such as observability and controllability.
3. Construction of input/output systems, i.e. mappings (or encoders) between sequence spaces.
4. Understanding the special role that algebraic structure (in particular, linearity and duality) plays in 1,2 and 3.

Yet these subjects have developed somewhat independently, and each has its own language and points of view. Until recently there has been very little communication among researchers in these subjects. A main purpose of week 2 of the IMA workshop is to further the communication among researchers and stimulate connections among these subjects. Week 2 will aim to continue a successful series of interdisciplinary meetings that has included an IEEE Information Theory Workshop on Coding, Systems and Symbolic Dynamics in 1993 (Mansfield, MA), a special invited session at the IEEE Conference on Decision and Control in 1995 (New Orleans), and two special sessions at the MTNS in 1998 (Padova).

Topics for week 2 include: Behavioral system theory, input/output mappings between spaces of sequences, state space representations, group codes, trellis codes, multi-dimensional systems and codes.

The organizers plan a number of invited tutorial lectures specifically for interspecialty communication. Leading workers in each field will also be invited to present surveys of current research, with less emphasis on solved problems than on open ones. Finally, there will be both invited and contributed papers presenting recent research results.

We expect the attendees to represent electrical engineering, mathematics and computer science departments in both academia and industry. As coding theory is the glue that holds the two weeks together, we expect that it will mostly be a subset of the coding theory participants who will attend both weeks.

CONFIRMED SUMMER PROGRAM VISITORS: August 3–18, 1988 (as of 19 December 1998)

Summer Program: Coding and Cryptography

ADLER, ROY	IBM (TJ Watson Research Center)	AUG 7 – 13
AGRAWAL, DAKSHI	Univ. of Illinois at Urbana-Champa	JUL 31 – AUG 6
ALLEN, BRIAN	Univ. of Notre Dame (Mathematics)	JUL 31 – AUG 13
ANANTHARAM, VENKAT	Univ. of California - Berkeley (EE/CS	AUG 1 – 6
ANDERSON, JOHN	Univ. of Lund (Information Technology)	JUL 31 – AUG 6
BEAL, MARIE-PIERRE	Univ. do Marne-la-Vallee (Gaspard Monge)	AUG 7 – 14
BIGLIERI, EZIO	Politecnico di Torino (di Elettronica)	JUL 31 – AUG 6
BOND, JAMES	SAIC Inc	JUL 31 – AUG 6
BOYLE, MIKE	Univ. of Maryland (Mathematics)	AUG 7 – 13
BRUCK, SHUKI	Caltech (Electrical Engineering)	JUL 31 – AUG 6
BRUCKS, KAREN	Univ. of Wisconsin - Milwaukee (Computer Science)	AUG 7 – 13
BRYANT, RANDY	Carnegie Mellon University	JUL 31 – AUG 6
CALDERBANK, ROBERT	AT&T Labs - Research	JUL 31 – AUG 6
COSTELLO, DAN	Univ. of Notre Dame (Electrical Engineering)	JUL 31 – AUG 6
COVEN, ETHAN	Wesleyan Univ. (Mathematics)	AUG 7 – 13
FAGNANI, FABIO	Politecnico di Torino (Scuola Normale Superiore)	AUG 7 – 13
FITZPATRICK, PATRICK	Univ. College - Cork (Mathematics)	AUG 7 – 13
FORNEY, DAVID	Motorola	JUL 31 – AUG 13
FREY, BRENDAN	University Illinois - Urbana	JUL 31 – AUG 6
FROUGNY, CHRISTIANE	LIAFA (France)	AUG 7 – 13
FUHRMANN, PAUL	Ben Gurion Univ. of the Negev (Mathematics)	AUG 7 – 13
HELMKE, UWE	Univ. of Wuerzburg (Mathematics)	AUG 7 – 13
HUANG, DANRUN	St. Cloud State (Mathematics)	AUG 1 – 13
JOHANNESSON, ROLF	Univ. of Lund (Information Theory)	AUG 2 – 13
JONOSKA, NATASHA	Univ. of South Florida (Mathematics)	AUG 7 – 13
KAWSKI, MATTHIAS	Arizona State Univ. (Mathematics)	AUG 7 – 13
KIM, SAEJOON	Cornell Univ. (Electrical Engineering)	AUG 1 – 14
KITCHENS, BRUCE	IBM Watson Research Center	AUG 7 – 13
KOETTER, RALF	University Illinois	JUL 31 – AUG 13
KSCHISCHANG, FRANK	Univ. of Toronto (Electrical & Computer Eng)	JUL 31 – AUG 13
KUIJPER, MARGREET	Univ. of Melbourne (Electrical & Electronic Engine)	AUG 7 – 13
LAFFERTY, JOHN	Carnegie Mellon Univ. (School Computer Science)	JUL 31 – AUG 6
LIND, DOUGLAS	Univ. of Washington (Mathematics)	AUG 7 – 13
LOELIGER, HANS-ANDREA	Endora Tech AG	JUL 31 – AUG 13
LUBY, MICHAEL		JUL 31 – AUG 6
MACKAY, DAVID	Cambridge Univ. (Physics)	JUL 31 – AUG 6
MARCUS, BRIAN	IBM	JUL 31 – AUG 13
MARTIN, CLYDE	Texas Tech Univ. (Mathematics)	AUG 7 – 13
MASSEY, JIM	Copenhagen	JUL 31 – AUG 13
MCELIECE, ROBERT	Caltech (Electrical Engineering)	JUL 31 – AUG 13
MITTELHOLZER, THOMAS	R3 Security Engineering AG	AUG 7 – 13
MITTER, SANJOY	MIT (Lab for Information & Decision Systems)	AUG 1 – 13
O'SULLIVAN, MIKE	Univ. College Cork (Mathematics)	AUG 7 – 13
ORMES, NICHOLAS	Univ. of Texas at Austin (Mathematics)	AUG 7 – 13
PARKS, ALAN	Lawrence Univ. (Mathematics)	AUG 1 – 14

PERRIN, DOMINIQUE	Univ. Marne la Vallee	AUG 7 – 13
PETERSEN, KARL	Univ. of North Carolina (Mathematics)	AUG 7 – 13
PILLAI, HARISH KUMAR	Univ. of Groningen (Mathematics)	AUG 1 – 14
RAVI, M.S.	East Carolina Univ. (Mathematics)	AUG 7 – 13
RICHARDSON, TOM	Bell Labs	JUL 31 – AUG 6
ROSENTHAL, JOACHIM	University Notre Dame	JUL 31 – AUG 13
SCHMIDT, KLAUS	Univ. of Vienna (Mathematics)	AUG 7 – 13
SHOKROLLAHI, AMIN	Bell Labs	JUL 31 – AUG 6
SIEGEL, PAUL	Univ. of California - San Diego (Electrical/Computer Eng.)	JUL 31 – AUG 13
SMARANDACHE, ROXANA	Univ. of Notre Dame (Mathematics)	AUG 7 – 13
SOLJANIN, EMINA	Bell Laboratories	AUG 7 – 13
TANNER, MICHAEL	Univ. of California - Santa Cruz (Computer Science)	JUL 31 – AUG 6
TAYLOR, THOMAS	Arizona State Univ. (Mathematics)	AUG 7 – 13
TROW, PAUL	Univ. of Memphis (Mathematical Sciences)	AUG 7 – 13
TUNCEL, SELIM	Univ. of Washington (Mathematics)	AUG 7 – 13
VALCHER, MARIA	Univ. di Padova (Dipartimento Elettronica)	AUG 7 – 13
VARDY, ALEXANDER	University California - San Diego	JUL 31 – AUG 13
WAN, ZHE-XIAN	Lund University	AUG 1 – 13
WEINER, PAUL	Saint Mary's Univ. of Minnesota (Mathematics)	AUG 7 – 13
WEISS, CHRISTIAN	Munich Univ. of Technology	AUG 1 – 6
WEISS, YAIR	University California - Berkeley	JUL 31 – AUG 6
WIBERG, NICLAS	Ericsson	JUL 31 – AUG 6
WICKER, STEPHEN B.	Cornell Univ. (School Electrical Engineering)	AUG 1 – 14
WILLEMS, JAN	Univ. of Groningen (Mathematics)	AUG 7 – 13
ZAMPIERI, SANDRO	Univ. di Padova	AUG 7 – 13

IV. IMA Hot Topics Workshops

IMA Hot Topics Workshop: Challenges and Opportunities in Genomics: Production, Storage, Mining and Use April 24-27, 1999

For details on this workshop see the Fall 1998 Update or
URL: `http://www.ima.umn.edu/biology/spring/genomics.html`

IMA Hot Topics Workshop: "Decision Making Under Uncertainty: Energy and Environmental Models" July 20-24, 1999

Organizers:

Francois Auzerais	Schlumberger	auzerais@ridgefield.sdr.slb.com
Bob Burridge	Schlumberger	burridge@ridgefield.sdr.slb.com
Claude Greengard	IBM	greenga@watson.ibm.com
Roger Wets	UC Davis	rjbwets@ucdavis.edu

For the most current information on this workshop see
URL: `http://www.ima.umn.edu/decision-making/decision-making.html`

Almost all (important) decision problems involve some level of uncertainty either about data measurements, the values to assign to parameters describing future evolution or even about the environment in which one has to operate. The main objective of this workshop is to set up a dialogue between Industry and Academia about modeling issues and the supporting mathematical methodology that would be useful to deal with uncertainty in decision making. This workshop will be centered around problems where the uncertainty is of a technological nature, in particular as it comes up in the production of energy, the extraction of natural resources and (ground) water remediation. Both practitioners and scientific researchers

will be involved, and the interaction between these groups will be an important feature of the workshop. The first day will be devoted mostly to a review of the major issues that must be dealt with when setting up stochastic optimization models. This will be followed by a limited number of invited lectures that will address more specific models and questions as they arise in applications. Other lecturers will provide a description of the numerical procedures and strategies that have been developed for certain classes of stochastic programming problems. To foster interaction, time has been reserved for two panel discussions, for impromptu talks, contributed talks and more informal exchanges between the participants.

CONFIRMED WORKSHOP PARTICIPANTS: July 20–24, 1999 (as of 19 December 1998)

AUZERAIS, FRANCOIS	Schlumberger-Doll Research Center	JUL 19 – 24
BURRIDGE, ROBERT	Schlumberger-Doll Research Center	JUL 19 – 24
COUET, BENOIT	Schlumberger-Doll Research Center	JUL 19 – 24
EWING, RICHARD	Texas A&M University	JUL 19 – 24
GREENGARD, CLAUDE	IBM (Watson Reseearch Ctr)	JUL 19 – 24
HOLDEN, LARS	Norwegian Computer Center	JUL 19 – 24
INGRAM, JOHN	Schlumberger Research Fellow	JUL 19 – 24
JACOBS, JONATHAN	PG. & E. - Energy Services	JUL 19 – 24
JOFRE, ALEJANDRO	Univ. de Chile (Math Engineering)	JUL 19 – 24
JOHNSON, VIRGINIA	Univ. of California (Lawrence Livermore National Laboratory)	JUL 19 – 24
KORF, LISA	IBM (Watson Research Center)	JUL 19 – 24
LUCERO, SERGIO	Univ. of California - Davis (Mathematics)	JUL 19 – 24
MALINVERNO, ALBERTO	Schlumberger-Doll Research	JUL 19 – 24
PHILPOTT, ANDREW	Univ. of Auckland (Engineering Science)	JUL 19 – 24
ROEMISCH, WERNER	Humboldt-Univ. Berlin (Fachbereich Mathematik)	JUL 19 – 24
ROGERS, LEAH L.	Lawrence Livermore National Laboratory	JUL 19 – 24
RUSZCZYNSKI, ANDRZEJ	Rutgers Univ. (Management Science)	JUL 19 – 24
SEN, SUVRAJEET	Univ. of Arizona (Systems and Industrial Eng.)	JUL 19 – 24
SHOEMAKER, CHRISTINE A.	Cornell Univ. (Civil & Environmental Engineering)	JUL 19 – 24
SMEERS, YVES	Univ. Catholique de Louvain	JUL 19 – 24
TAKRITI, SAMER	IBM (Watson Research Ctr)	JUL 19 – 24
TOMPSON, ANDREW	Lawrence Livermore National Laboratory	JUL 19 – 24
WALLACE, STEIN	The Norwegian Institute of Technology	JUL 19 – 24

IMA Hot Topics Workshop: "Scaling Phenomena in Communication Networks " October 22-24, 1999

Cosponsored by DIMACS

Organizers:

Ashok Erramilli	Bellcore Research/Netmetrix Inc.	ashok@netmetrix.com
Vern Paxson	Lawrence Berkeley National Laboratory	vern@ee.lbl.gov
Iraj Saniee	Lucent Technologies	iis@research.bell-labs.com
Walter Willinger	AT&T-Labs Research	walter@research.att.com

For the most current information on this workshop see
URL: `http://www.ima.umn.edu/reactive/fall/networks.html`

The study of scaling phenomena in modern communication networks is another realization of Mandelbrot's vision of order in physical and social phenomena that are characterized by scaling laws. This exciting new multi-disciplinary field has attracted the attention of researchers from networking, mathematicians with interest in fractal geometry, physicists experienced in dealing with scaling laws, and computer scientists, economists and control theorists concerned with robustness and scaling issues associated with complex large-scale interacting systems. Moreover, developments in this field have been accompanied by the availability of extended, high quality data sets of network traffic measurements that are unprecedented in other disciplines. This 3-day workshop is intended to bring together the leading researchers in this emerging area, representing its various constituencies. Its main objective is to foster the exchange of ideas between leading networking experts and researchers in other fields, matching problem areas with solution methods.

The workshop will be structured around three fundamental aspects of the study of scaling phenomena in networks: description (e.g., empirical evidence, physical understanding, dynamical systems); analysis (e.g., network performance with fractal traffic flows, renormalization group techniques for large scale distributed systems, mean-field theory approaches for full-service networks); and control (e.g., self-organization; pattern formation, evolution and adaptation in spatially extended non-equilibrium systems). Participants are expected to contribute to this effort by giving a talk and/or actively engaging in the proceedings. In contrast to many other fields where scaling phenomena have had a long history but have not moved beyond the descriptive stage, this area shows great potential to apply the theory to analyze and control complex, large-scale networks such as the Internet. It is expected that this workshop will advance the study of scaling phenomena in networks from a descriptive theory to a prescriptive reality.

CONFIRMED WORKSHOP PARTICIPANTS: October 22–24, 1999 (as of 19 December 1998)

ABRY, PATRICE	CNRS (Laboratoire Physique)	OCT 21 – 24
BALAKRISHNAN, HARI	Massachusetts Institute of Technology (EE/CS)	OCT 21 – 24
BOXMA, ONNO	Eindhoven Univ. of Technology (Computing Science)	OCT 21 – 24
CALDERBANK, ROB	AT&T Labs	OCT 21 – 24
CROVELLA, MARK	Boston Univ. (Computer Science)	OCT 21 – 24
DAUBECHIES, INGRID	Princeton Univ. (Mathematics)	OCT 21 – 24
DONOHO, DAVID	Stanford Univ. (Statistics)	OCT 21 – 24
FLANDRIN, PATRICK	Ecole Normale Superieure de Lyon (Laboratoire Physique)	OCT 21 – 24
FLOYD, SALLY	Univ. of California-Berkeley (Network Research Group)	OCT 21 – 24
GILBERT, ANNA	AT&T Labs-Research (Shannon Laboratory)	OCT 21 – 24
KANT, KRISHNA	Intel	OCT 21 – 24
KETTENRING, JON	Bellcore (Mathematical Sciences Research Center)	OCT 21 – 24
KURTZ, TOM	Univ. of Wisconsin - Madison (Center the Mathematical Sciences)	OCT 21 – 24
LEWIS, DON	National Science Foundation (DMS)	OCT 21 – 24
MANDELBROT, BENOIT	IBM	OCT 21 – 24
NARAYAN, ONUTTOM	Univ. of California (Physics)	OCT 21 – 24
NEIDHARDT, ARNIE	Bellcore (Mathematical Sciences Research Center)	OCT 21 – 24
NORROS, ILKKA	VIT Telecommunications	OCT 21 – 24
PAXSON, VERN	Univ. of California-Berkeley (Network Research Group)	OCT 21 – 24
RESNICK, SID	Cornell Univ. (Operations Research)	OCT 21 – 24
RIEDI, ROLF	Rice Univ.	OCT 21 – 24
ROBERTS, JIM	CNET France Telecom	OCT 21 – 24
SHENKER, SCOTT	Xerox (Palo Alto Research Center)	OCT 21 – 24
SORNETTE, DIDIER	UCLA (Earth & Space Sciences)	OCT 21 – 24
SREENIVASAN, K.R.	Yale Univ. (Mechanical Engineering)	OCT 21 – 24
STROGATZ, STEVEN	Cornell Univ. (Theoretical & Applied Math)	OCT 21 – 24
TAKAYASU, HIDEKI	Sony Computer Science Laboratory	OCT 21 – 24
TAQQU, MURAD	Boston Univ. (Mathematics)	OCT 21 – 24
TOWSLEY, DON	Univ. of Massachusetts (Computer Science)	OCT 21 – 24
TURCOTTE, DONALD	Cornell Univ. (Geological Sciences)	OCT 21 – 24
VEITCH, DARRYL	Royal Melbourne Institute of Technology (SERC)	OCT 21 – 24
WAYMIRE, ED	Oregon State Univ. (Mathematics)	OCT 21 – 24

V. THE IMA VOLUMES IN MATHEMATICS AND ITS APPLICATIONS

THE IMA VOLUMES IN MATHEMATICS AND ITS APPLICATIONS

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Volume 105: Algorithms for Parallel Processing
Editors: Robert S. Schreiber, Michael T. Heath, and Abhiram Ranade

This book's chapters offer a wide-ranging tour of recent developments in the very rapidly growing and changing field of parallel algorithms. They cover the following general areas:

- models and mechanisms for parallel machines (Chapters 1–4),
- discrete and combinatorial algorithms (Chapters 5–7),
- mathematical issues in parallelizing compilers (Chapter 8),
- parallel algorithms for matrix computation, differential equations, random number generation, and Fourier methods (Chapters 9–14),
- new parallel computer systems and software (Chapters 15–16).

Volume 106: Parallel Processing of Discrete Problems
Editor: Panos Pardalos

In the past two decades, breakthroughs in computer technology have made a tremendous impact on optimization. In particular, availability of parallel computers has created substantial interest in exploring the use of parallel processing for solving discrete and global optimization problems. The collection of articles in this volume covers a broad spectrum of recent research in parallel processing of discrete and related problems. The topics discussed include distributed branch-and-bound algorithms, parallel genetic algorithms for large scale discrete problems, simulated annealing, parallel branch-and-bound search under limited-memory constraints, parallelization of greedy randomized adaptive search procedures, parallel optical models of computing, randomized parallel algorithms, general techniques for the design of parallel discrete algorithms, parallel algorithms for the solution of quadratic assignment and satisfiability problems. The book will be a valuable source of information to faculty, students and researchers in combinatorial optimization and related areas.

Volume 107: The Mathematics of Information Coding, Extraction, and Distribution
Editors: George Cybenko, Dianne O'Leary, and Jorma Rissanen

High performance computing consumes and generates vast amounts of data, and the storage, retrieval, and transmission of these data are major obstacles to effective use of computing power. Challenges inherent in all of these operations are security, speed, reliability, authentication, and reproducibility. This workshop focused on a wide variety of technical results aimed at meeting these challenges. Topics ranging from the mathematics of coding theory to the practicalities of copyright preservation for Internet resources drew spirited discussion and interaction among experts in diverse but related fields. We hope this volume contributes to continuing this dialogue.

Volume 108: Rational Drug Design
Editors: Donald G. Truhlar, W. Jeffrey Howe, Anthony J. Hopfinger, Jeff Blaney, and Richard A. Dammkoehler

Drug research and discovery are of critical importance in human health care. Computational approaches for drug lead discovery and optimization have proven successful in many recent research programs. These methods have grown in their effectiveness not only because of improved understanding of the basic science – the biological events and molecular interactions that define a target for therapeutic intervention – but also because of advances in algorithms, representations,

and mathematical procedures for studying such processes. This volume surveys some of those advances. A broad landscape of high-profile topics in computer-assisted molecular design (CAMD) directed to drug design are included.

Subject areas represented in the volume include receptor-based applications such as binding energy approximations, molecular docking, and de novo design; non-receptor-based applications such as molecular similarity; molecular dynamics simulations; solvation and partitioning of a solute between aqueous and nonpolar media; graph theory; non-linear multidimensional optimization, processing of information obtained from simulation studies, global optimization and search strategies, and performance enhancement through parallel computing.

Volume 109: Emerging Applications of Number Theory
Editors: Dennis A. Hejhal, Joel Friedman, Martin C. Gutzwiller, and Andrew M. Odlyzko

Most people tend to view number theory as the very paradigm of pure mathematics. With the advent of computers, however, number theory has been finding an increasing number of applications in practical settings, such as in cryptography, random number generation, coding theory, and even concert hall acoustics. Yet other applications are still emerging — providing number theorists with some major new areas of opportunity.

The 1996 IMA summer program on *Emerging Applications of Number Theory* was aimed at stimulating further work with some of these newest (and most attractive) applications.

Concentration was on number theory's recent links with:

(a) wave phenomena in quantum mechanics (more specifically, quantum chaos); and

(b) graph theory (especially expander graphs and related spectral theory).

This volume contains the contributed papers from that meeting and will be of interest to anyone intrigued by novel applications of modern number-theoretical techniques.

Volume 110: Computational Radiology and Imaging: Therapy and Diagnostics
Editors: Christoph Börgers and Frank Natterer

The articles collected in this volume are based on lectures at the IMA Workshop "Computational Radiology and Imaging: Therapy and Diagnostics", March 17–21, 1997. Introductory articles by the editors have been added. The focus is on inverse problems involving electromagnetic radiation and particle beams, with applications to X-ray tomography, nuclear medicine, near-infrared imaging, microwave imaging, electron microscopy, and radiation therapy planning.

Mathematical and computational tools and models which play important roles in this volume include the X-ray transform and other integral transforms, the linear Boltzmann equation and, for near-infrared imaging, its diffusion approximation, iterative methods for large linear and non-linear least-squares problems, iterative methods for linear feasibility problems, and optimization methods.

The volume is intended not only for mathematical scientists and engineers working on these and related problems, but also for non-specialists. It contains much introductory expository material, and a large number of references. Many unsolved computational and mathematical problems of substantial practical importance are pointed out.

Volume 111: Evolutionary Algorithms
Editors: Lawrence David Davis, Kenneth De Jong, Michael D. Vose and L. Darrell Whitley

The IMA Workshop on Evolutionary Algorithms brought together many of the top researchers working in the area of Evolutionary Computation for a week of intensive interaction. The field of Evolutionary Computation has developed significantly over the past 30 years and today consists a variety of subfields such as genetic algorithms, evolution strategies, evolutionary programming, and genetic programming, each with their own algorithmic perspectives and goals.

The workshop did a great deal to clarify the current state of the theory in Evolutionary Algorithms. The existing theory might be characterized as deriving from two principal approaches. There is a high level macro-theory that looks at the processing of "building blocks" and "schemata" that are shared by many good solutions when searching a problem space. There is also a low level micro-theory that builds exact Markov models of the search process. It is sometimes hard for researchers working at such different levels of abstraction to interact. The IMA workshop allowed researchers working at these different levels to present their points of view and to move toward common ground.

There was real progress was in communication between theorist and practitioners in the evolutionary computation field. Speakers presented applications across a wide range of problem areas. In some of those cases, theoretically motivated methods work quite well. In other cases, practitioners used domain-based methods to obtain better performance than could be achieved by using a "pure" evolutionary algorithm. Individuals on both sides went away with a better appreciation of the successes and failures of current theory. The workshop should help to change what practitioners say about the current state of theory in the field.

Volume 112: Statistics in Genetics
Editors: M. Elizabeth Halloran and Seymour Geisser

This volume contains refereed papers from a workshop on Statistics in Genetics held as part of the six-week symposium on Statistics in the Health Sciences held by the Institute of Mathematics and its Applications in the summer of 1997. The week on genetics provided a forum for lively discussion among an unusual mix of statistical scientists and population geneticists.

The field of statistical genetics is growing and expanding. Though the Genome Project will eventually result in the sequencing of the human genome, as well as the genomes of several other organisms, there will still be a need for good statistics for family studies of complex diseases. Of special interest is the growing recognition of the potential role of interaction of mitochondrial genes with nuclear genes to produce many chronic or degenerative disorders. There is still much room for improving model building in phylogenetics analysis, particularly in understanding inference in this arena. The use of statistics for assessing identification in criminal and paternity cases through DNA is also becoming more widespread. The controversy over these methods are likely to rage for many years to come.

The papers in this volume are contributions by some of the leading researchers in the field to the current topics in in statistical genetics. One section deals with DNA sequence matching and issues related to forensics. Another group of papers deals with statistical problems of modeling phylogenies and inferential difficulties related to the complex tree structures produced, as well as the method of coalecence. Another group of papers are concerned with human genetics, including the identification of disease genes, and the genetics of cancer.

Volume 113: Grid Generation and Adaptive Algorithms
Editors: Marshall Bern, Joseph E. Flaherty, and Mitchell Luskin

The papers in this volume are based on lectures given at the IMA Workshop on Grid Generation and Adaptive Algorithms held during April 28–May 2, 1997. Grid generation is a common feature of many computational tasks which require the discretization and representation of space and surfaces. The papers in this volume discuss how the geometric complexity of the physical object or the non-uniform nature of the solution variable make it impossible to use a uniform grid. Since an efficient grid requires knowledge of the computed solution, many of the papers in this volume treat how to construct grids that are adaptively computed with the solution.

This volume will be of interest to computational scientists and mathematicians working in a broad variety of applications including fluid mechanics, solid mechanics, materials science, chemistry, and physics. Papers treat residual-based error estimation and adaptivity, repartitioning and load balancing for adaptive meshes, data structures and local refinement methods for conservation laws, adaptivity for hp-finite element methods, the resolution of boundary layers in high Reynolds number flow, adaptive methods for elastostatic contact problems, the full domain partition approach to parallel adaptive refinement, the adaptive solution of phase change problems, and quality indicators for triangular meshes.

Volume 114: Diagnosis and Prediction
Editors: Seymour Geisser

This volume contains refereed papers submitted by participants of the third week of a six week workshop on Statistics in the Health Sciences held by the Institute of Mathematics and its Applications in Minneapolis, Minnesota during July of 1997. This week was devoted to the closely related topics of Diagnosis and Prediction.

Theoretical and applied statisticians from Universities, Medical and Public Health Schools, government and private research institutions, and pharmaceutical companies involved in prediction problems in the life and social sciences and in diagnostic and screening tests were brought together to discuss and exchange new results and information on these important issues. A number of papers with applications were presented and especially lively discussions ensued involving the critical issues and difficulties in using and interpreting diagnostic tests and implementing mass screening programs. Both frequentist and Bayesian approaches were employed.

The importance of predicting or controlling future events such as survival, comparative survival and survival post intervention for a disease or even for certain biological or natural events is growing rapidly. This area of concern was also represented by participants who presented work that devised predictive methodology for a variety of problems mainly from a Bayesian perspective.

Forthcoming Volumes:

1996–1997: *Mathematics in High Performance Computing*

Structured Adaptive Mesh Refinement Grid Methods

Parallel Solution of Partial Differential Equations

1997 Summer Program:

Statistics in the Health Sciences

Week 2: Imaging

Weeks 4 and 5: Design and Analysis of Clinical Trials

Week 6: Statistics and Epidemiology: Environment and Health

1997–1998: Emerging Applications of Dynamical Systems

Numerical Methods for Bifurcation Problems

Large Scale Dynamical Systems

Multiple-Time-Scale Dynamical Systems

Dynamics of Algorithms

Algorithmic Methods for Semi-Conductor Circuitry

Pattern Formation in Continuous and Coupled Systems

1998–1999: Mathematics in Biology

Pattern Formation and Morphogenesis in Developmental Biology