



PIMS 1999 Thematic Programs: Math Biology & Experimental Mathematics

Reflecting the overwhelming enthusiasm and success of the last two thematic programs, PIMS is now aiming to feature two such programs per year. Thematic programs are intensive periods of scientific activity covering a specific research area in the mathematical sciences. Each year, at least one of the thematic programs will be chosen to reach out to another area, either scientific, industrial, or social.

PIMS thematic programs feature workshops and conferences attended by world experts, tutorials and minicourses for nonexperts and graduate students, and public lectures, exhibits, etc. In 1999, PIMS will feature two summer-long thematic programs: Math Biology, and Constructive and Experimental Mathematics.

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NSERC Visits PIMS on September 14

The long awaited site visit to determine PIMS NSERC grant will take place on September 14 at the University of British Columbia. Also competing are the other two major Canadian Math. Institutes: the Fields Institute in Toronto and the Centre de Recherches Mathematiques in Montreal.

Reflecting the importance of this event, a large number of scientists, administrators and industrialists from across Alberta and British Columbia are expected to participate in the site visit. PIMS' strength is the large number of scientists at all PIMS universities who over the last three years have built the institute despite the lack of NSERC funding and gone on to run high quality scientific events. More than 100 scientists from across Western Canada will be at the site visit speaking directly to the committee and relating the importance of PIMS to their scientific lives. A session with graduate students and post-docs is also scheduled. The visiting panel consists of Brian Barry, Chair, (Object Tech. International), T. Liggett (UCLA), A. Van der Poorten (Macquarie), P. Freund (Chicago) and J. Spencer (NYU).

The PIMS Collaborative Industrial Program

Forming industry-university teams

In collaboration with the Alberta Science Research Authority and the British Columbia Information, Science and Technology Agency, PIMS has implemented the PIMS Collaborative Industrial Program. The program encourages teams of researchers with common interests and complementary expertise to develop around specific industrial long-term projects in collaboration with appropriate industrial partners. These projects are usually identified by the industrial partners as being timely and strategic. The teams work to identify a course of action for attacking the problem; this can be anything from the scientists providing a report on the current state of the literature to initiating a new research project for finding a solution to a new problem. PIMS provides each team with administrative help, industrial contacts, and funds to hire graduate students or post-doctoral fellows.

PIMS collaborative teams often come together at one of the PIMS problem solving events. Two such events, the PIMS Industrial Problem Solving Workshop and the PIMS Industrial Seminar Series have been particularly effective. Many of these teams are also participating in the MITACS NCE; a decision on MITACS is expected by mid-October.

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Director's Notes:

Nassif Ghoussoub

In the last four months, we have seen more than a dozen of PIMS scientific and outreach activities taking place. The multitude, the variety and the high scientific level of these events were simply non-imaginable only a couple of years ago, even by the most optimistic among us. So I shall again use this page to thank those responsible for this new installment to the success story of our young institute.

- The month of May started with the *Canadian Operator Theory and Operator Algebras Symposium* in Edmonton. The success of this annual event was due to the organizational efforts of **Anthony Lau** and **Brian Marcoux** from the University of Alberta.

- In May, I had the opportunity to witness the energy, excitement and camaraderie of the graduate students involved in the *PIMS Industrial Modeling Training Camp* at SFU. Thank you **Keith Promislow** (SFU) and **Huaxiong Huang** (PIMS) for your selfless efforts.

- The second *PIMS Industrial Problem-Solving Workshop* was held in June in Calgary. It was even better than the first one thanks to the sustained collective efforts of **Rex Westwood**, **Dan Calistrate** and **Mark Paulhus** all from Calgary.

- The *Pacific Rim Geometry conference* at UBC was particularly exciting as most of the best geometers in the world were at hand, among us for a week...courtesy of the organisers: **David Austin** and **Jim Carrell**.

- Thanks to **Richard Cleve** (Calgary) for the ground-breaking workshop in Banff, Alberta on *Networks and Computer security*.

- I shall never forget the Herculean efforts of **John Weymark** (Economics, UBC) and **Bill Ziemba** (Management, UBC) for the summer-long feast on the theme of *Mathematical Economics and Finance*. The two of them--and their US and European colleagues-- were practically responsible for the organization of 9 different scientific conferences, workshops and tutorial sessions attended by more than 500 participants.

- Thank you **Anthony Peirce** (UBC) for teaching us how to organize the ultimate workshop. This PIMS event on *Microstructural Models of Rock Fracture* was structured to stimulate open discussion about questions and problems that were submitted and circulated before the workshop.

- PIMS pioneer and Head of UVic's math. department **Reinhard Illner**, managed somehow to find the time and energy to organize a superb conference on the *Mathematical Aspects of Fluid and Plasma Dynamics* in Maui: A joint effort with the Tokyo Institute of Technology and the Center for Mathematical Sciences at the University of Wisconsin.

- Thanks to **Hadi Kharagani** (U. Lethbridge) for organizing the first PIMS meeting in Lethbridge on *Coding Theory, Cryptography and Computer Security*.

- PIMS also sponsored several Pacific Northwest Seminars and other regional conferences: Probability Theory (Ed Perkins and Martin Barlow, UBC), Number theory (David Boyd, UBC and Peter Borwein, SFU), Optimization and Control Theory (Philip Loewen, UBC, and Jon Borwein, SFU), Linear Algebra and applications (Peter Lancaster, Calgary, and Pauline Van den Driessche).

PIMS industrial partners participate in site visit for Mathematics NCE proposal

On June 8, PIMS scientists and industrial partners travelled to Toronto to take part in the site visit for the *Mathematics of Information Technology and Complex Systems* (MITACS) NCE proposal. This proposal is one of 11 currently being considered for funding by the three research granting agencies in Canada. The proposal is ambitious in scope, encompassing mathematical modelling techniques from a large cross-section of the Canadian business communities including bio-technology, manufacturing, information technology, the financial sector and the industrial sector.

PIMS played a key role in formulating MITACS. Of the 21 projects that constitute MITACS, nine are centered at PIMS universities. Should MITACS be funded, PIMS will act as the administrative centre for all projects with a Western component. More than 80 PIMS scientists and 25 PIMS affiliated companies are part of MITACS.

Travelling to Toronto with PIMS scientists were Randy Savoie, the Director, Product development at Ballard Power Systems and David Glassco, the President and CEO of FinancialCad. Also present to defend the MITACS proposal were Claudine Simson, VP-Global External Research at Nortel and Peter Nicholson, Executive VP-Corporate Strategy at BCE Inc. All industrial scientists present spoke for the increasing need for sophisticated mathematical tools and expertise in their business domains. They made it clear to the committee that for their firms to compete in the global marketplace they need access to high-quality mathematical research and researchers.

MITACS is a joint initiative of the three mathematical science institutes in Canada: PIMS, the Fields Institute in Toronto and the CRM in Montreal. A funding decision from the NCE should be announced in mid- October. Of the 11 proposals under consideration, it is expected that 3 or 4 will be chosen for funding.

PIMS holds its First Graduate Math Modeling Camp

From May 25 to 29, PIMS hosted almost 40 graduate (and soon to be graduate) students from across Canada on the SFU campus for the first annual PIMS graduate math modeling camp. Organized by Keith Promislow (SFU) and Huaxiong Huang (PIMS Industrial Facilitator), the students came to learn leading edge techniques for modeling industrial mathematics problems from distinguished mentors in the field. The participants were housed on campus to build camaraderie and to allow for impromptu meetings. At the start of the workshop, each mentor described a real-life industrial problem. The students then divided into teams, one per problem and mentor, to begin a week-long intensive session under the watchful eye of the mentor. Frequent breaks allowed students from different teams to compare notes and give each other advice. On the last day each team presented their findings. The teams have now written reports on their work which are available as proceedings on the PIMS web page. On completing the camp, the students had a chance to try out their newly acquired skills at the second PIMS Industrial Problem Solving Workshop in Calgary the subsequent week.

Everyone involved with the camp felt the enthusiasm generated by the camp. The mentors commented on the dedication and preparedness of the students. Colin Please, a mentor from Southampton University and a veteran at these types of camps felt it was one of the best he has ever seen.

Mentors and Problems at the Math Modeling Camp

1. **Optimal Policies for Queuing Systems** (Mentor: Rachel Kuske, Minnesota).
2. **Traffic Control** (Mentor: Luis Goddyn, SFU).
3. **Air Impact Molding** (Mentor: Colin Please, Southampton).
4. **Model of Gelation** (Mentor: David Ross, Eastman Kodak).
5. **Electrical Coupling Synchronized Intracellular Calcium Oscillations** (Mentor: Yue-Xian Li, UBC).

Problems at the Second PIMS Industrial Problem Solving Workshop

1. **Boeing Corporation.** Devise a financial strategy to deal with the large year to year fluctuations in the demand of planes paying particular attention to the massive lay-offs and hirings this causes.
2. **Computer Modeling Group.** Model the flow of oil and water when water is injected into an oil field. Water is often injected into petroleum reservoirs to increase the production of oil from the field.
3. **Geomech Project.** Determine the profile of core underground structures from seismic waves that are sent from a source to a receiver. Geomech is a joint project of Petro-Canada, PanCanadian, Talisman and Western Atlas.
4. **ITRES Research Ltd.** Develop techniques for visually recognizing trip-wires on land mines from images in real-time. Canada is already a global leader in the decommissioning of land mines.
5. **Powertech Labs.** Devise models for the stress on multistrand cables. Such models directly impact, for example, how well electrical lines will perform during an ice storm.
6. **VisionSmart.** Develop an algorithm to read illumination data from candeled eggs and determine deformities (cracks, pinholes, cage marks, etc). This will be used for sorting eggs for packaging.

PIMS Industrial Problem Solving Workshop: a Resounding Success

The second annual PIMS Industrial Problem Solving Workshop (June 1-5, 1998) was an overwhelming success. Organized by Rex Westbrooke (U Calgary), Marc Paulhus (PIMS Industrial Facilitator) and Dan Calistrate (PIMS Industrial PDF) on the campus of the University of Calgary. More than 100 scientists (almost half of them students) spent the week working in teams to solve difficult mathematical problems posed by industrial researchers. Problems ranged from how to detect land mine trip wires to how to help Boeing deal with the fluctuations in their plane orders (see box).

A new feature at this year's workshop was the inclusion of graduate students from across Canada who had just attended the first PIMS Graduate Mathematics Modelling Camp at SFU. The enthusiasm and stamina of the students kept many of the faculty working late into the night. On the final day, the teams presented their results to the industrial scientists. There was universal praise by the industrialists for the work done by the teams and more than one company expressed an interest in continuing the work started at the workshop. PIMS is now working with the teams to help them make applications to the PIMS Collaborative Industrial Program to continue this work.

This workshop is an integral part of the PIMS industrial strategy. PIMS' mandate is to find ways for industry and academic researchers to come together on problems that they find mutually interesting. At this workshop, the PIMS industrial facilitators carefully screened industrial problems to find those which would be most interesting to the participants. They also helped the industrial researchers prepare their presentations and made sure background material on each of the problems was available to the participants.

Next year's PIMS Industrial Forum

The 1999 Graduate Camp will be held at the University of Alberta. The organizing committee consists of Gordon Swaters (Chair), Sam Schen, H. Huang, M. Paulhus and J. Vardalas.

The 3rd Industrial Problem Solving Workshop will be held at the University of Victoria. The organizing committee consists of D. Hewgill (Chair), R. Illner, H. Huang, and F. Ruskey.

PIMS announces

The Annual Summer School in Computational Fluid Dynamics at the University of Alberta

Starting in 1999, the Environmental and Industrial Fluid Dynamics Laboratory at the University of Alberta will host the PIMS annual summer school on fluid dynamics. The intended audience for the school are graduate students and industrial researchers in the area of fluid dynamics.

During this two-week training period, participants will be exposed to fundamentals as well as modern techniques in several areas of fluid dynamics. They will be given opportunities to work with experts and to use state-of-the-art experimental and computing facilities at the fluid dynamics laboratory. The topics of the 1999 summer school include numerical solutions of the Navier-Stokes equations, turbulence, geophysical, industrial and environmental fluids, and laboratory techniques.

PIMS Thematic Summer in Math. Economics & Finance

The major event at PIMS this summer was the Thematic Summer on Economics and Finance. This consisted of seven workshops and two major conferences organized around the central theme of mathematical problems arising in the social sciences, economics and finance. The first of the major conferences was the *IV International Meeting of the Society for Social Choice and Welfare*, held on July 3-6, which PIMS jointly sponsored with the Centre for Applied Ethics at UBC. With over 200 contributed papers, this meeting was highly successful. The second of the major conferences was the *VII International Conference on Stochastic Programming*. This was co-sponsored by PIMS, the Fields Institute, the Frank Russel Company, Falcon Asset Management, IBM, The Math Consulting Group, AG, The faculty of Commerce at UBC and Algorithmics, Inc. and also had over 200 participants. This conference focused on a wide variety of applications of stochastic modelling in areas such as financial modelling and engineering.

Built around these two major conferences was a series of smaller workshops. More informal in nature than the major conferences, these workshops facilitated close interaction between mathematical scientists and experts in various areas of economics and finance. The workshops on the Economics part were *Workshop on Mathematical Methods and Models for Social Choice and Distributive Justice*, *Summer Conference on Industrial Organization*, *Workshop on Design of Markets and Organizations Under Incomplete Information* and the *Workshop on recent Developments in Mathematical Economics*.

The workshops in the Finance part of the programme were *The VII International Conference on Stochastic Programming: Tutorial Programme* and *The Asset and Liability Management Seminar for Institutional Investors*. PIMS is committed to mixing smaller workshops of this type with larger conferences, in order to create an atmosphere in which interdisciplinary research can thrive. The vibrant nature of these workshops can attest to the success of this approach.

Fluid Dynamics Workshop in Maui

Over eighty experts from Asia, Australia, Europe and the Americas gathered in the pleasant setting of Wailea, Maui, for the Fifth International Workshop on Mathematical Aspects of Fluid and Plasma Dynamics. In keeping with its mandate to foster connections with the Pacific Rim, and thanks to the efforts of Reinhard Illner (U. Vic), PIMS was a major sponsor of the event, from June 28 to July 3, 1998, together with the following co-sponsors: the Maui Research and Technology Centre, Tokyo Institute of Technology and the Center for Mathematical Sciences, University of Wisconsin. The lively meeting covered a range of mathematical topics relating to fluids and plasma, including phenomenological modeling, nonlinear partial and ordinary differential equations, numerical techniques, quantum particle systems, spectral theory and vortex rings.

PIMS Workshop on Micro-Structural Models of Rock Fracture

Recent advances in computer technology have stimulated new avenues of research for scientists interested in understanding the fundamental micro-structural processes involved in the fracture of brittle materials. The objective of this workshop was to bring together scientists who have been at the vanguard of the computational effort with theoretical physicists, material scientists, and mathematicians to try to build continuum theories to explain the success or failure of these micro-structural models.

This workshop, organized by Anthony Peirce (UBC), was structured to stimulate open discussion. A unique feature of the workshop was that participants were asked to prepare a list of open questions that they would like to have discussed at the meeting. Those questions were submitted before the workshop and circulated to all the participants so that they had a chance to think about the questions and to bring any supporting material that might illuminate the discussions. The lectures in the workshop were divided into four main themes: I Particle models and analysis, II Explicit damage models and failure criteria, III Experimentation, IV Continuum modelling of micro-structure - multiple scales. At the end of each theme, a question session was scheduled. The debates in these sessions were scheduled for one hour but often went on for two hours and spilled over into lunch and dinner. A number of new initiatives and plans for collaboration have resulted from the workshop. As an example, the participants have agreed to compile a database of experimental data for ten different models of experiments. The database will be accessible on the Internet so that modellers can download the experimental data to compare with their theoretical or computational models. There will also be a place on the web site to post the results of the models.

The Pacific Rim Geometry Conference

The Pacific Institute was host to the fourth meeting of the Pacific Rim Geometry Conference -- the first to be held in North America. The high quality of this event is evident from the list of plenary speakers, all world leaders: J. Chen, K. Fukaya, W. Fulton, A. Givental, J.M. Hwang, J. Li, P. Li, B. Lian, C. Taubes, R. Schoen, G. Tian and K. Uhlenbeck.

Leading-edge research in geometry was covered in special sessions on Gauge Theory, Riemannian Geometry, Minimal Surfaces, and Geometry & Physics. The meeting took place on the UBC campus June 28 to July 2, 1998, and was attended by over 75 mathematicians. A special effort was made to include (and provide support for) graduate students, with twenty participating. The local organizers, David Austin and Jim Carrell, were particularly pleased by the accessibility of the lectures, as well as their mathematical quality.

PIMS Preprint Series - An Update

The PIMS electronic preprint series is now ready to receive submissions. Contributions from mathematical scientists at any PIMS institution will be accepted in LaTeX form. Please send submissions by email to the PIMS Scientific Coordinator, Sandy Rutherford, at sandy@math.ubc.ca.

Reflect, Renew and Refresh 3 R's for Mathematics Education

There were a number of PIMS activities that took place during the last academic year which were facilitated by the Education Panel of PIMS. At the end of the academic year members of the BCAMT Executive and PIMS were put in touch with each other with the goal of establishing a formal link between the two for mutual support and collaboration. In addition, contact has already been established to form the first formal link between PIMS and a school district in British Columbia, Coquitlam School District (#43), providing each partner with opportunities for direct contacts between mathematicians and students. PIMS provides a unique opportunity, which was highlighted at its "Changing the Culture" Education conference in February, of bringing together educators from all levels of education to promote and discuss mathematics education. Both as individuals and together with mathematics educators those associated with PIMS can provide powerful quality learning opportunities to many students if even a small amount of time is taken to again reflect, renew and refresh a commitment to education. Carpe diem!

Pamela Hagen

International Math Olympiad: A Canadian Success Story

The Pacific Institute is proud to report that four Canadian high school students won medals at the 1998 International Mathematical Olympiad in Taiwan this summer. PIMS was a sponsor of the IMO training camp in Calgary, immediately preceding the competition in July 1998. A Gold Medal was awarded to Adrian Chan, a Silver Medal to Mihaela Enachescu and Bronze Medals to Jimmy Chui and Adrian Tang. Jessie Lei received an Honourable Mention. The six members of the Canadian IMO team were selected from among more than 200,000 students who participated in local, provincial and national mathematics contests. Overall, Canada placed 20th out of 76 competing countries.

The IMO is the world championship of high school mathematics competition. The problems were very difficult and all six students have done extremely well and demonstrated the critical problem solving skills, knowledge and creativity required to compete at this very high level," said Dr. Graham Wright, Executive Director of the Canadian Mathematical Society (CMS), the organization responsible for the selection and training of Canada's IMO team. "They have represented Canada very well and we are all very proud of their performance."

First PIMS Postdoctoral Fellows Conference

A unique conference is being planned by PIMS as a forum for the PIMS postdoctoral fellows to discuss their research and become acquainted with their colleagues at other sites. Fifteen PDF's from all five PIMS sites in BC and Alberta will give presentations on Sept. 12 and 13 on the UBC campus. A sampling of titles includes: Rigorous renormalization group, Classification of certain C^* algebras, Perturbations of analytic matrix functions, 3D models of geological structures, and Intra-nest transmission of honey bee pheromones. The meeting will showcase the diversity of talent and interests of the PIMS postdocs. It is open to all interested persons; further information can be found on the PIMS website.

Canadian Undergraduate Mathematics Conference

The University of British Columbia was host to the fifth Annual Canadian Undergraduate Mathematics Conference, July 9 - 12, 1998. PIMS was a main sponsor of the event, which turned out to be a major success. It was attended by over eighty undergraduate math students from 18 universities across Canada. Of particular note was the strong participation by francophone students; two of the plenary lectures were *en francais*, delivered by the noted French mathematicians Ivar Ekeland and Herve Moulin. Other plenary speakers were David Austin, Leah Keshet and Peter Borwein.

The great enthusiasm of the student participants was reflected in the high quality of the 35 lectures delivered by undergraduates on topics ranging from analysis and computer science to statistics, topology and wavelet theory. This unique annual event is organized and run by undergraduates; Michael Kozdron was the president of the local organizing committee. Besides PIMS, sponsors for the event included the UBC Math Club, the UBC Math Department, Statistics Department, Faculty of Science and Science Undergraduate Society of UBC, the Canadian Math Society and the Canadian Society for the History and Philosophy of Mathematics.

A PIMS Education Task Force for BC

In recognition of the high priority that PIMS places on educational outreach, PIMS Board of directors has established a task force to develop new initiatives for academics to interact with public school students, their teachers as well as the general public. The task force is expected to report by year end. A similar panel will be constituted shortly in Alberta. Please contact any member of the committee with your suggestions:

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PIMS Thematic Summer 1999: Mathematical Biology at UBC

A Thematic Summer on Mathematical Biology will be held at the University of British Columbia, Vancouver, B.C. Canada during June, July, and August 1999. The purpose of this Thematic Summer is to bring together researchers at various levels of expertise in an environment where focussed talks will be given in several different areas of mathematical biology. The workshops for this Summer Program and each organizer are:

- **Genomics** (Michael Waterman, University of Southern California) - May 31-June 11, 1999
- **Physiology** (Robert Miura, University of British Columbia) - June 14-25, 1999
- **Epidemiology** (Pauline van den Driessche, University of Victoria) - July 19-30, 1999
- **Ecology** (Marc Mangel, University of California, Santa Cruz) - August 2-13, 1999
- **Cell Biology** (Leah Keshet, University of British Columbia) - August 16-27, 1999.

A break of three weeks in the latter part of June and first half of July is to allow participants and speakers to attend the International Conference on Theory and Mathematics in Biology and Medicine in Amsterdam (June 29-July 3, 1999; the Annual Meeting of the Society for Mathematical Biology is being held in conjunction with this conference) and the International Conference on Industrial and Applied Mathematics in Edinburgh (July 5-9, 1999).

Each of the five workshops in this Special Summer program will run for two weeks and will include tutorial, general, and research talks. Formal talks by invited speakers will be interspersed with informal seminars and ample time for detailed discussions among the participants. More details on the workshops, updates on the invited speakers, and application forms can be found at the website:

<http://pims.math.ca/sections/activities/bio.html>

Proposed Thematic Program 1999: Constructive & Experimental Mathematics at SFU

The proposal is to run a focused summer research program on experimental and constructive mathematics. Central issues include techniques in computer assisted proof and discovery. A good example is the work by this year's AMS Steele Prize for innovative research winners (Wilf and Zeilberger) on automatic proofs of analytic identities.

Organizers: J. Borwein, P. Borwein, L. Goddyn, L. Jorgensen, M. Monagan, S. Braham (SFU); D. Boyd (UBC).

- **High performance computation**
- **Distributed/network communication and computation**
- **Computational discrete mathematics**
- **Computational number theory**
- **Experimental and computational analysis**
- **Computational algebra.**

The subthemes are linked but each will represent a two week period of focus. In the middle of this period, a moderate sized (three day) conference on topics in *experimental mathematics* (CECM99) will be organized. At the end of the period, participants will be able to attend ISSAC '99 which is being held in late July in Vancouver and also sponsored by PIMS. There would also be a variety of focused (stand alone) activities in and around issues in electronic presentation of mathematics.

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