

PIMS Industrial Programme (in BC)

PIMS, in partnership with the Mathematics of Information Technology and Complex Systems Network of Centres of Excellence (MITACS), is committed to connecting the considerable expertise in mathematical sciences research at the PIMS universities with the public and private sectors. Detailed information on PIMS Industrial Programmes can be found at <http://www.pims.math.ca/industrial/index.html>.

Industrial Postdoctoral Fellowships

Each year, industrial partners cosponsor postdoctoral fellowships at the various PIMS universities. PIMS/Industry Postdoctoral Fellows are named by the PIMS Director. PIMS provides matching funding to the industrial partner's contribution, and the remaining salary amount is covered by the supervisor.

Industrial Problem Solving Programme

PIMS Industrial Problem Solving Workshops (IPSW) are one of PIMS' biggest successes. They continue to:

- Foster contacts between academia and industry, often leading to long-term research collaborations.
- Introduce challenging new research areas with a direct bearing on physical problems to academics and their graduate students.
 - Develop highly qualified personnel from the participation of graduate students and postdoctoral fellows.
 - Provide Canadian industry with new ideas and approaches to solving current technical problems.

IPSW is held annually at a PIMS university. The aim of IPSW is to create a mutually beneficial link between researchers in industry and academic mathematicians. Researchers with industrial and commercial concerns are invited to present one of their current technical problems. Leading specialists from the academic community study these problems in teams during the week-long workshop, and present the results of their study back to the industrial participants at the end of the week. Problems can come from a wide variety of subject areas, but should be amenable to mathematical modelling and analysis. PIMS publishes a book of proceedings from each IPSW, which is available on-line.

Industrial Training Programme

In all its activities and programmes, PIMS places a high priority on the development of young research-

ers and each of the PIMS industrial programmes has a training component associated with it. The main goal is to educate young mathematical scientists in methods of modelling, numerical methods, simulation and other techniques of problem-solving and to provide them with opportunities to interact with the industrial sector. Specific initiatives include an intensive industrial training camp, and summer schools on specific topics.

Graduate Industrial Mathematics Modelling Camp

Each year during the week preceding the IPSW, PIMS hosts the Graduate Industrial Mathematics Modelling Camp (GIMMC). This camp teaches graduate students mathematical modelling methods from experts in the field. A cross-section of relevant industrial problems and modelling techniques are presented. Students have the chance to explore discrete and continuous models, to develop deterministic and stochastic techniques and to deal with problems from the manufacturing, industrial, and biomedical sectors. The mentors are all renowned for their work in industrial mathematics and work in either an academic or an industrial setting.

PIMS-IAM Senior Undergraduate Math Modelling Workshop

An annual workshop in industrial problem solving for senior undergraduate students in the mathematical sciences is held each February at UBC and SFU. The objective of this program is to provide a selection of the top undergraduate students in mathematics in Canada with the opportunity to see firsthand how useful mathematics can be when applied to industrial problems. A number of faculty mentors present problems and some background material that the students will require to analyze the problems, then guide the students through the process of modelling and analyzing the problems.

Other PIMS Summer Schools

PIMS offer a variety of summer schools. A full list is on the PIMS website.

Industrial Outreach Seminars

Industrial Outreach Seminars give PIMS faculty members the opportunity to bring current research in the mathematical sciences to the attention of researchers in the private and public sectors.

The PIMS Industrial Problem Solving Workshop

The PIMS Industrial Problem Solving Workshop (IPSW) is the flagship of the PIMS Industrial Programme.

The format of the **Industrial Problem Solving Workshops** is mainly based on the Oxford Study Group Model, in which problems of relevant and current interest to the participating companies are posed to the workshop participants by experts from industry. The participating graduate students and academics will spend five days working on the problems and the results will be published in the workshop's proceedings. The advantages for participating students and academics are:

- The challenge of applying one's skills to new and relevant problems directly applicable to industry.
- The opportunity for continued collaboration with the workshop's academic and industrial participants.
- Help PIMS and mathematics in general, by showing businesses and governments the tangible benefits of supporting the mathematical sciences.

These workshops have been held annually since 1997. The companies the IPSW industrial experts came from included:

- Boeing Corporation
- Husky Injection Molding Systems
- Lockheed-Martin
- Michelin Tire Corporation
- Random Knowledge
- Powertech Labs
- Schlumberger

The problems looked at have covered a broad range of disciplines and have sometimes resulted in significant cost saving solutions for the companies involved.

More information, including the IPSW proceedings can be found at www.pims.math.ca/industrial/.



Lalitha Venkataramanan of Schlumberger Doll Research explains NMR remote sensing to graduate students Ying Han, Lin Zhou, Quingguo Li, Qian Wang and Xinghua Deng.



"Handwaving explanations" in a conversation between Carlos Tolmasky (Cargill) and Rachel Kuske (UBC).

The PIMS Graduate Industrial Mathematics Modelling Camp



The GIMMC 2004 Mentors (left-right): C. Sean Bohun (Penn State U), Tim Myers (U of Cape Town), Tobias Schaefer (U of North Carolina at Chapel Hill), Petra Berenbrink (SFU), Randall Pyke (UC of the Fraser Valley, Abbotsford, BC) and Peter Ehlers (U of C)

The Graduate Mathematics Modelling Camp (GIMMC) gives graduate students in the Mathematical Sciences an opportunity to learn techniques of mathematical modelling under the supervision and guidance of experts in the field. GIMMC is the first leg of the PIMS Industrial Mathematics Forum which also includes IPSW. In a first session, the mentors present the problems, and for the remainder of the week, they guide a group of graduate students through to a resolution, this culminates in a group presentation and a written document at the end of the week.

For more information, including the GIMMC proceedings, please see www.pims.math.ca/industrial/gimmc.html.



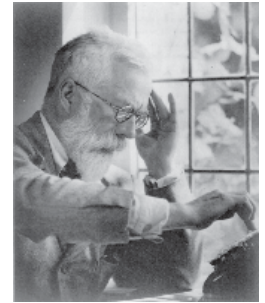
Some of the camp mentors take a hike: Richard Braun, Rachel Kuske, David Misemer, Emily Stone, Robert Piche, Fadil Santosa.



Graduate students Thalya Burden, Ying Han, Samet Kadioglu, Xinghua Deng, Lin Zhou, and Tzvetalin Vassilev worked on the problem that Robert Piché brought, namely, how to generate 3D geometric models using data from a measurement “arm”.

The National Program on Complex Data Structures

PIMS supports the National Programme on Complex Data Structures (NPCDS). The broad goal of the programme is to foster nationally coordinated projects with substantial interactions with the large community of scientists involved in analysis of complex data sets, and to establish a framework for national networking of research activities in the statistical community. More specific objectives of the programme include the development of collaborations between university and extra-university researchers, and the provision of training for graduate students in important scientific areas through these collaborations. Information about the program may be found at www.pims.math.ca/NPCDS/.



Fisher, father of modern statistics

Undergraduate Math Modelling Workshops

PIMS supports **Undergraduate Math Modelling Workshops**. Faculty mentors first outline applied problems to all the participants. The students then choose one of the problems to work on each day. Lectures on each of the problems are presented by the mentors, and the tools for the modelling and analysis of the problem are developed. The mentors then help the students develop the models and answer the questions posed. The workshops culminate with presentations by each of the groups.



Undergraduate Modelling Workshop participants at SFU

PIMS Crystal Growth Workshops at UBC

The mandate of the PIMS Crystal Growth Workshop group is to improve semiconductor manufacturing through scientific modelling. Since the inaugural meeting in May 2002, advances have been made in three specific areas: 1) Modelling the crucible fluid flow; 2) Analysis of the gas flow and heat transfer; and 3) Understanding the crystal stress, shape and growth dynamics. Research is ongoing and the industrial partner is beginning to implement some of the suggested changes to the growing environment identified by the modelling team. The crystal group consists of researchers from across Canada, the United States, and South Africa.

PIMS-IAM Distinguished Lectures

These lectures take place in BC.

September 20, 2004

George Homsy, UC Santa Barbara

Novel Marangoni Flows

October 25, 2004

Ray Goldstein, U. Arizona

A Stirring Tale of Bacterial Swimming and Chemotaxis

November 29, 2004

Andrea Bertozzi, UCLA

Higher Order PDEs in Image Processing

January 24, 2005

Roger Brockett, Harvard University

Dynamical Systems That Do Tricks

March 7, 2005

Adrian Nachman, U. Toronto

Inverse Problems in Medical Imaging

March 28, 2005

Ray Pierrehumbert, University of Chicago

Early-Life Crises of Habitable Planets



The Crystal Group: Standing, from left-right, are Naveen Vaidya (York), Shuqing Liang (York), Mike Ebbelohj (UBC), Thomas Brakel (UBC/Cape Town), Colin Carrew (Firebird Semiconductors), Ian Frigaard (UBC). Sitting are C. Sean Bohun (Penn State) and Bill Micklethwaite (Firebird Semiconductors). Missing are Huaxiong Huang (York), Tim Myers (Cape Town) and Yuri Skrynnikov (UBC).