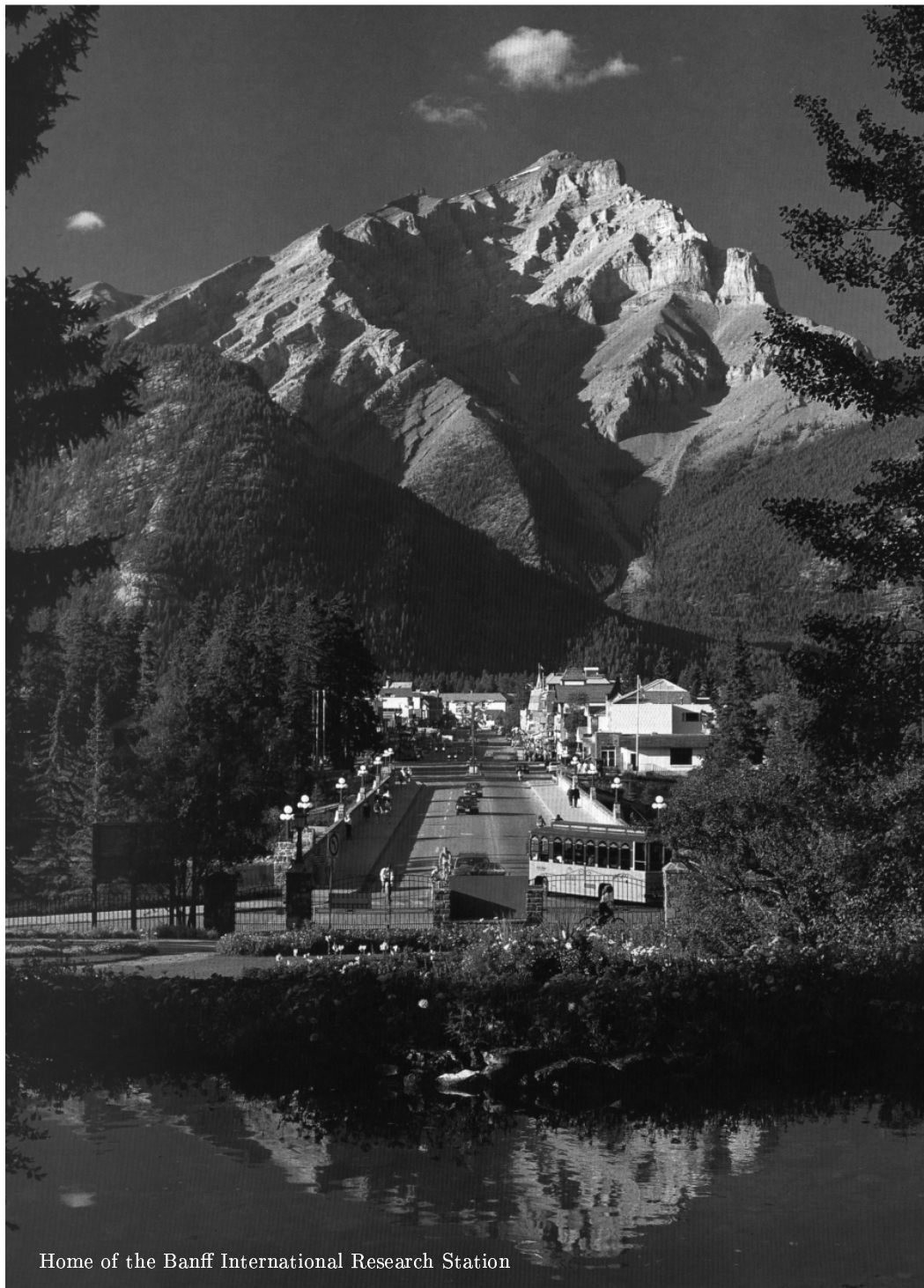


Pacific Institute for the Mathematical Sciences



Home of the Banff International Research Station

Institute Report 2000/2001

The Pacific Institute for the Mathematical Sciences

Our Mission

The Pacific Institute for the Mathematical Sciences (PIMS) was created in 1996 by the community of mathematical scientists in Alberta and British Columbia and in 2000, they were joined in their endeavour by their colleagues in the State of Washington. PIMS is dedicated to:

- Promoting innovation and excellence in research in all areas encompassed by the mathematical sciences;
- Initiating collaborations and strengthening ties between the mathematical scientists in the academic community and those in the industrial, business and government sectors;
- Training highly qualified personnel for academic and industrial employment and creating new opportunities for developing scientists;
- Developing new technologies to support research, communication and training in the mathematical sciences.

Building on the strength and vitality of its programs, PIMS is able to serve the mathematical sciences community as a catalyst in other areas of great importance:

- The communication and Dissemination of mathematical ideas; Public Outreach, Mathematical Education and Training at all school levels;
- The creation of strong mathematical partnerships and links within Canada and organizations in other countries, with a focus on the nations of the Pacific Rim.

Our Community

PIMS is a partnership between the following organizations and people:

- The six participating universities (Simon Fraser U., U. of Alberta, U. of British Columbia, U. of Calgary, U. of Victoria, U. of Washington) and affiliated Institutions (U. of Lethbridge and U. of Northern British Columbia).
- The Government of British Columbia through the Ministry of Competition, Science and Enterprise, The Government of Alberta through the Alberta Ministry of Innovation and Science, and The Government of Canada through the Natural Sciences and Engineering Research Council of Canada.
- Over 350 scientists in its member universities who are actively working towards the Institute's mandate. Their disciplines include pure and applied mathematics, statistics, computer science, physical, chemical and life sciences, medical science, finance, management, and several engineering fields.
- Scientists, practitioners and government researchers using mathematical ideas in dozens of companies across Canada and the U.S.
- A large and rapidly growing group of high school and elementary school teachers and educators in Alberta, British Columbia and Washington State.

From the Chair of the Board

Hugh Morris, FRSC



Hugh Morris, Chair of the PIMS board of directors.

After three years of interaction with a dynamic mathematical science community in Canada, I can proudly say that my association with the PIMS organization continues to be an exhilarating experience. From the very beginning, I was fascinated by the energy, the vitality and the pace that the mathematical scientists of PIMS were putting into their task. This year, I have witnessed the dramatic emergence of PIMS on the international scene where it solidified its stature as one of the most innovative research institutes in the mathematical sciences.

The integration of the University of Washington into the operations of PIMS, and the institute's support for the mathematical community in all of the US Pacific Northwest is unprecedented. The initiation of a Canada-US partnership to launch the Banff International Research Station (BIRS) is an amazing tour de force, especially when it is seen in light of the various partnerships that PIMS has created along the way: First, between the provinces of Alberta and British Columbia, then between western provincial governments and the federal government of Canada, then with the groundbreaking NSF-

NSERC partnership and last but not least with the hugely and mutually beneficial PIMS-MSRI partnership. All this is destined to provide a tremendous boost for research in the mathematical sciences all over the world.

This annual report represents a compendium of the various activities and programmes organized and supported by PIMS during its second year of fully-funded operations, together with a glimpse at the planned busy programme ahead. PIMS not only strives to be a world-class research institute in the mathematical sciences, but also to be prominent in the application of mathematics to industry and in mathematics education at all levels.

Through its Industrial Problem Solving Programme and its Industrial Math Training Programme, PIMS has played a key role in bringing mathematical scientists in academia together with their counterparts in the private sector. This year's "Month of Industrial Mathematics at PIMS" with coordinated activities between Vancouver, Victoria, Edmonton, Burnaby and Seattle provided a wealth of new opportunities to Canadian and US graduate students.

This year has also seen a large growth in PIMS involvement in mathematics education. Through such initiatives as the *Women and Mathematics* poster campaign and the *Pi in the Sky* magazine, PIMS is helping educate the youth of Canada on the importance of mathematics in the future of their society.

My warmest congratulations to the director, Dr. Nassif Ghoussoub and to all mathematical scientists of PIMS for their wonderful accomplishments.

Director's Notes

Nassif Ghoussoub, FRSC

September 2001 marks my fifth year as Director of PIMS. The first three-years were an interim period where, besides the quest for securing funds and sponsorships, the institute's emphasis was on developing a new cohesive and collaborative spirit among the mathematical scientists at its five founding universities as well as on providing a major stimulus for organized research activities in Western Canada.

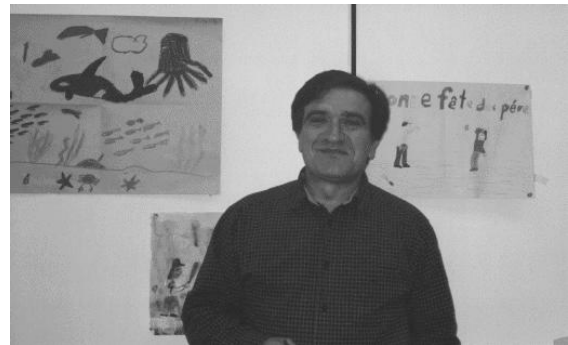
The institute moved to full operations in 1999/2000, a year that also saw the emergence of PIMS as a leading national institution, thanks to its defining role in conceiving and developing the MITACS Network of Centres of Excellence (Mathematics of Information Technology and Complex Systems), in partnership with its sister institutes in central Canada: the CRM and the Fields Institute. Moreover, PIMS other groundbreaking outreach programs also solidified its reputation as one of the most innovative research institutions in the world.

I am happy to report that this past year 2000/01 has seen PIMS emerge in many ways as a major player on the international scientific scene. The institutes programs kept evolving to optimize the opportunities for our scientists and our national and international partnerships kept multiplying. Here are some of the highlights of an amazing year.

The integration of the mathematical sciences community at the University of Washington, into both the operations and management of PIMS. This unprecedented partnership has provided a formidable boost to the

institute's mandate of promoting all aspects of the mathematical sciences. A partnership on such a scale between the 6 major universities in this region builds on already existing substantial links between the scientific communities of Western Canada and the US Pacific Northwest and is destined to open up a whole new era of scientific collaborations between the mathematical communities of the two countries.

The development of the Banff International Research Station (BIRS) in the Canadian Rockies. This unique Canada-US joint venture was developed in partnership with the Berkeley-based Mathematical Science Research Institute (MSRI) and has already received the support of the US National Science Foundation (NSF), of the Alberta Science Research Authority (ASRA) and from NSERC's Major Facilities Access Program. BIRS represents a long awaited North-American counterpart to the highly successful program of the *Mathematisches*



Nassif Ghoussoub, Director of PIMS

Forschungsinstitut Oberwolfach in Germany. We have so far received 118 scientific proposals for the 40 slots available for the BIRS program in 2003, confirming again the extraordinary level of interest and support by the scientific community. More than 1600 mathematical scientists from all over the world are expected to participate in the Station's activities every year.

The leadership of PIMS within the Pacific rim. Faithful to its mandate, the institute pushed ahead with the development of sustained scientific links with several Pacific rim countries. An official cooperative agreement with the Asia Pacific Center for Theoretical Physics (APCTP) in Korea cemented an ongoing partnership on annual joint programs in mathematical physics. PIMS has again represented Canada in the second Pacific Rim Conference in Taipei and will be hosting the third such a conference in 2004. PIMS has again assumed its leadership in the Canada-China Mathematics initiative by organizing its second congress in Vancouver under the watchful and caring eyes of NSERC's President Tom Brzustowski. PIMS will again partner with the NSF, this time in the coordination of a Pan-American Advanced Studies Institute on Inverse Problems (PASI) in Santiago, Chile in 2003.

The development of two Research Facilities. PIMS scientists can now count on the institute's facility at SFU which had been readied just on time to host the 3rd Graduate modeling Camp in May, 2000. The UBC facility of PIMS was already inaugurated on June 15th, 1999. Both facilities include computer labs, office space for PIMS' postdoctoral fellows, visitors and participants in the thematic programmes as well as interdisciplinary space where industrial partners, math educators get together with PIMS' mathematical scientists to discuss, initiate and develop whatever it takes to achieve their common goals.

Lectures by PIMS distinguished scientists and visitors are now available over the internet using on-demand streaming video. PIMS is the first institute in Canada to offer such

a service to the world's mathematical community. The lecture by H.S.M. Coxeter on "The Mathematics in the Art of M.C. Escher" and the one by Nobel Laureate Sir Professor Andrew Huxley on the "Hodgkin-Huxley models" during their visits to PIMS are illustrations of what we hope can be seen and appreciated by generations of mathematicians to come.

The implementation of the PIMS Distinguished Chair Programme which supports extended visits by distinguished mathematical scientists to the various PIMS participating universities. So far, the chairs were held by Yuri Matiyasevich (Steklov Institute) during a six week visit to the University of Calgary, by Herbert S. Wilf at the University of Victoria, by S. Donkin at the University of Alberta, by David Brydges at UBC and by Michael Shelley at SFU.

The Month of Industrial Mathematics at PIMS which saw a concentrated and coordinated series of industrially oriented workshops: on *Industrial Fluid Dynamics* in Alberta, on *Inverse problems and imaging* at UBC, on *Computational fuel cells* at SFU, an *Industrial Graduate Modeling Camp* in Victoria followed by the *Industrial Problem Solving Workshop* in Seattle. More than 300 scientists, including 80 graduate students contributed to the success of this groundbreaking programme.

More than fifty companies have so far participated in the PIMS/MITACS Collaborative Industrial Programme sponsoring projects of our researchers with contributions nearing 2 million dollars over the last two years.

Innovative Mathematic Education initiatives starting with a new poster campaign under the theme *Women and Mathematics* which followed last year's highly successful *Mathematics is everywhere* campaign that featured the ever growing importance of Mathematics in modern society. A semi-annual magazine entitled *Pi in the Sky* designed to be a forum for dialogue between academic mathematical scientists, educators, students and the public at large. PIMS has been distributing this magazine across

high schools in western Canada and the Pacific Northwest. *Hypatia Street Theater*: A delightful play, sponsored by PIMS and organized around three mathematical skits, was attended by more than 300 people at Frederic Wood theater at UBC. The principal goal of the play was to show mathematics on stage –not just talking about it, but actually doing it– in whatever form the public can take.

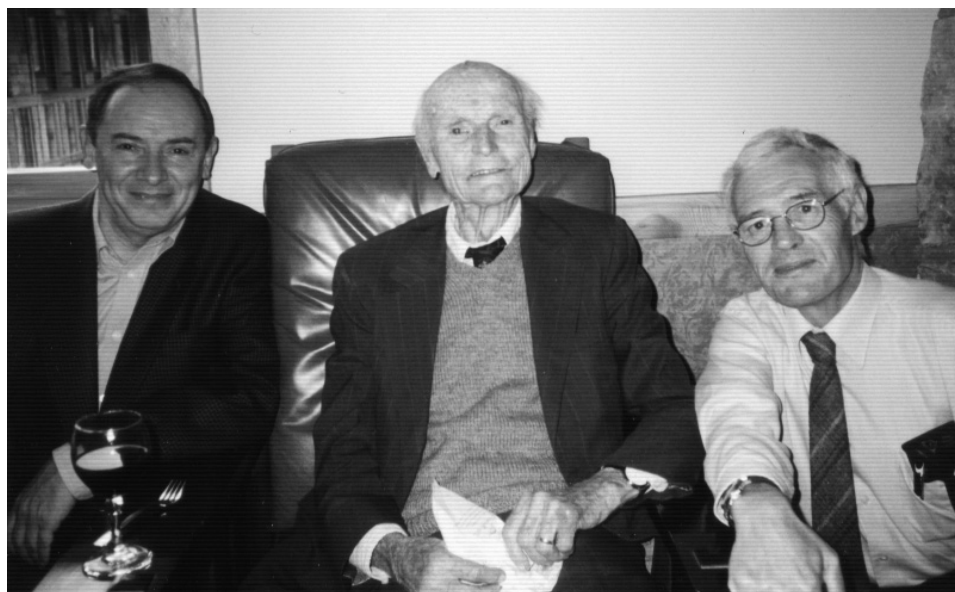
The PIMS prizes for mathematical research, education and industrial outreach were awarded for the first time, in an uplifting ceremony on December 12, 2000 to an outstanding group of researchers, applied mathematicians and educators.

On a personal note, I would like to say that the arduous journey of building PIMS wouldn't have been accomplished without the unconditional support and commitment of friends like Arvind Gupta and Ed Perkins. The road to the MITACS network couldn't have been travelled without visionary companions like Don Dawson, Luc Vinet and Steve Halperin. Here again, call it luck, I feel extraordinarily privileged to be working on BIRS with colleagues like Robert V. Moody and David Eisenbud. With their outstanding scientific credentials, vision, dedication and integrity, the Banff station will soon be

ready to be a great new resource for the world's scientific community.

The development of PIMS, MITACS and now BIRS should also be remembered as the culmination of a joint effort by a remarkable group of people who happen to be in leadership positions. Most of them are not mathematical scientists but simply great believers in the role of mathematics, its ramifications and its applications: Senior NSERC and NSF officials (Brzustowski, Lloyd, Menard, Colwell, Eisenstein, Tondeur and others) who are determined to encourage international collaborations in order to multiply the opportunities for their researchers; Senior Alberta officials (Taylor, Church, Palmer, Hill and others) who are totally committed to the R&D effort in their province; Senior administrators in the major Alberta and BC universities (Archer, Smith, Clayman, Taylor, Samarasekera, Peter, Boorman, McBride) who were so instrumental in getting PIMS on its feet, who were so supportive with the MITACS effort and who are now back again actively helping us build the Banff International Research Station.

Finally, I wish to express my warmest congratulations and gratitude to all PIMS mathematical scientists, partners and supporters in Canada, the US and elsewhere who made all this possible.



V. Kac, H. S. M. Coxeter and R. V. Moody at the Banff Centre.

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