

Overview of MITACS

January 11, 2011

MITACS, an NCE

MITACS was founded in 1999 by Canada's three mathematical sciences institutes (CRM, Fields, and PIMS) as a Canadian Networks of Centres of Excellence (NCE) to:

- Foster high-quality multi-disciplinary research by the academic mathematical sciences community that could produce novel mathematical tools and technologies applicable to industry, not-for-profits, hospitals, and government;
- Train the next generation of graduate students in the application of quantitative research and to create venues for them to be retained in Canada;
- Build a network between the Canadian mathematical sciences community and Canadian industry;
- Ensure rapid dissemination of knowledge;
- Leverage mathematical technologies for the benefit of Canada; and
- Act as a platform for international engagement in industrial and applied mathematics.

MITACS original annual budget was \$3.8M from the federal government through the NCE program. Within a year, industry was contributing an additional \$1.0M. By 2005, MITACS had grown to approximately 150 companies and 48 Canadian universities with a budget of \$7.5M, of which the federal government contributed \$5.4M. The main activity was large-scale research projects each involving a group of professors working with a consortium of companies. Today there are 38 such projects (see Appendix for a complete list).

Other programs launched and run by MITACS-NCE include:

- Industrial Seminar Series: About 20 such seminar series are run by MITACS projects. Examples:
 - Statistical methods for genetics & genomics,
 - Séminaire MITACS: Les mathématiques des supra conducteurs,
 - Seminar Series on Fusion and Inference in Surveillance Networks,
 - Applied Mathematics and Mathematical Physics Seminar,
 - Optimization Seminar series.
- Workshops: MITACS fosters workshops in industrial and applied mathematical sciences across the country. About 60 workshops are held each year. Examples:
 - Workshop on Theory of Quantum Computation,
 - Communication and Cryptography,
 - Conference on Statistics in Industry and Technology,
 - Workshop on Decision Analysis and Sustainable Development
- Graduate (summer) schools: Each year MITACS hosts 10-15 intensive graduate schools in emerging areas where mathematics plays a central role. Examples:
 - Computational Neuroscience Summer School,
 - Mathematics for Biological Networks,
 - École d'été Optimisation du transport et de la chaîne logistique dans le secteur forestier
- BIRS: MITACS was one of the founders of BIRS and plays a major role in the management and in supporting scientific activities.

Note that many of these activities are run in partnership, especially with the 3 mathematical sciences institutes.

Going Beyond the NCE

To further fulfill its mandate, starting in 2004, MITACS developed a series of programs to reach out to industry in a more substantive way. The most successful was its **Accelerate** program whereby graduate students worked on high-quality research projects with industry. The goal was two-fold:

- Introduce industry to the power of high quality research on their challenges; and
- Introduce graduate students to industrial research and its potential to motivate the research enterprise.

As well, MITACS was looking to create new research employment opportunities for these graduate students.

The success of Accelerate is witnessed by its rapid growth:

- 17 projects in 2004 growing to 1,200 expected in 2010-11;
- More than 650 Canadian companies participating in Accelerate; and
- A 27% increase in graduate student retention in Canada.

Starting in 2007, the Accelerate program went from being solely focused on the mathematical sciences to being multi-disciplinary. Today, about 25% of the 1,200 internships carried out through Accelerate are in the mathematical sciences (12% are in mathematics and statistics).

Other substantive programs MITACS has launched include:

- *Outreach*: In collaboration with Prof. Jean-Marie de Koninck, MITACS has developed a substantive outreach program in Québec and British Columbia. The program has two highly popular components:
 - *ShowMath*: An interactive multi-media presentation targeted to high school students that highlighting the role of mathematics in student's everyday life.
 - *MathAmaze*: A multi-user internet based video game that allows players of varying skills to compete by answering mathematical questions.
- *Globalink*: A program that brings highly talented international undergraduates to Canada to work on an applied research project.
- *Step*: A series of workshops for graduate students on business and entrepreneurship.
- *Elevate*: A novel PDF program that develops scientific managerial skills amongst recent PhD's through partnerships with industry.

Mathematics within MITACS Inc.

MITACS continues to run its research projects and networking and training activities, all of which are focused on the mathematical sciences. In total, about \$7.5M is expended annually on these activities. Removing the administration portion, about \$3M goes directly to mathematics and statistics faculty from MITACS.

As well, the multi-disciplinary programming within MITACS has a substantial mathematics/statistics component. In the fiscal year 2010-11, this is estimated at about \$3.5M.

MITACS going forward

MITACS is proposing to divide into two organizations as of April 1, 2011. The first, Mprime Inc, would focus on the original mathematical mandate of MITACS. The second, Mitacs Inc, would focus on the multi-disciplinary training aspects of MITACS. Any reorganization of this form will require the approval of Canadian universities.

1	Mesoscale Hydrological Ensemble Forecasting for Water Resources Management
2	High Performance Optimization: Theory, Algorithm Design and Engineering Applications
3	Statistical learning of complex data with complex distributions
4	Facility Location Optimization
5	A Graphical Modeling Framework to Study Complex Dependence Patterns in High-Dimensional Biological Data
6	Assembly and Analysis of 2-base Encoded Sequencing Data
7	Statistical modelling and Analysis of Complex Traits
8	Fusion and Inference in Surveillance Networks
9	Modeling Trading and Risk in the Market
10	Mathematical and Statistical Methods for Financial Modelling and Risk Management
11	Optimization of Multi-modal Transport in the Forestry Sector
12	Control of cardiac arrhythmias
13	Useful Privacy Enhancing Technologies
14	Predictive modeling of coastal habitat distribution
15	Multi-scale Adaptive Modeling and Numerical Methods for Reactive Flows
16	Modelling and Mining of Networked Information Spaces
17	Reverse Engineering Cellular Complexity
18	Mathematics of Computer Algebra and Analysis
19	Pseudodifferential Operator Theory in Seismic Imaging
20	Multi-Format Environmental Information Dissemination
21	Optimizing Information Flows over the Internet: Routing and Coding with Non-cooperative Users
22	Pseudo-differential Operator Theory in Seismic Imaging
23	Advanced Parameter Estimation Tools for Building Mathematical Models of Chemical Processes
24	Modelling and Mining of Networked Information Spaces
25	Mathematics of Computer Algebra and Analysis
26	Useful Privacy Enhancing Technologies
27	Finsurance: Theory, Computation and Applications
28	Quantum Information Processing
29	Mathematical Surface Representations for Conceptual Design
30	Advanced Finite Element Techniques for Coupled magnetic and Thermal Problems in Superconductors
31	Advanced Mathematical Modelling and Simulation of Transport Phenomena
32	Simulating Climate Processes with High Resolution Regional Climate Model
33	Modeling Atmospheric Boundary-Layer Flow for Wind Energy and Other Applications
34	High performance optimization: theory, algorithm design and engineering applications
35	Control of cardiac arrhythmias
36	Network for Biological Invasions and Dispersal Research
37	Statistical Methods for Complex Survey Data
38	Novel Methods for Three-Dimensional Aerodynamic Optimization

APPENDIX: Large-Scale Research Projects