

Operations Research Center

The Operations Research Center (ORC), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 53rd year of operation in 2005–2006. The ORC administers its own graduate programs and a varied research program of methodological and applied projects. It maintains a reading room with a small library as well as state-of-the-art computational workstations.

This report summarizes ORC's AY2006 activities and briefly reviews its educational, research, and outreach programs.

Faculty, Students, Staff

Professor James B. Orlin, Edward Pennell Brooks professor of operations research, and Professor John N. Tsitsiklis of the Department of Electrical Engineering and Computer Science (EECS) served as codirectors during 2005–2006.

This year the ORC had 48 affiliated faculty and senior staff, with faculty drawn from the MIT Sloan School of Management and the Departments of EECS, Civil and Environmental Engineering, Mathematics, Aeronautics and Astronautics, Mechanical Engineering, Nuclear Science and Engineering, and Urban Studies and Planning.

ORC offers two interdepartmental graduate degree programs, a PhD and a master's degree. During the past year, these programs enrolled 48 students—38 PhD candidates, and 10 SM candidates. ORC conferred 8 master's degrees and 10 PhDs. Several other PhD theses were in the final stages of completion in the summer of 2006.

Academic Programs

The ORC's academic programs continue to be recognized as ranking among the very best nationally and internationally. Moreover, the programs are repeatedly cited as achieving an excellent balance between application and methodological domains.

Research Activities

Research activities spanned a wide spectrum of methodological topics and applications, ranging from small, unsponsored projects involving a single faculty supervising a student's thesis to much larger sponsored programs involving several faculty, staff, and students.

Methodological research includes such topics as linear, nonlinear, and combinatorial optimization; solution methods for integer programming; interior point methods for linear and nonlinear programming; dynamic programming; cluster analysis; parallel and distributed computation and algorithms; network flow algorithms; network design; probabilistic combinatorial optimization; deterministic and stochastic facility location; queueing theory, including queueing networks; risk analysis; stochastic processes; classical and Bayesian statistics; game theory; and decision analysis and statistical decision theory.

ORC faculty are also currently contributing to application domains as wide ranging as manufacturing, communications, transportation, public services, logistics, marketing, financial services, health care, and nuclear engineering. Current projects are addressing such topics as air traffic control, epidemiology, AIDS testing, life-cycle modeling of municipal solid waste, safety and risk analysis in air transportation, telecommunication network design, supply chain management, production scheduling, and transportation logistics.

Several organizations sponsored research projects at the ORC during 2005–2006, including Amazon Corporation, Defense Advanced Research Projects Agency, National Science Foundation, Draper Laboratory (several projects and Draper fellowships), General Motors, Lincoln Laboratory, Logistics Management Institute, Office of Naval Research, and the Singapore/MIT Alliance Program.

Outreach And Professional Service

In an effort to enhance the quality of life for ORC graduate students at MIT, the ORC staff submitted a proposal for a Graduate Student Life Grant and was awarded two years of funding that has been put towards a number of student-related initiatives throughout the past academic year. Some of the initiatives include:

- Tuesday Seminar Series—in an effort to provide a forum where OR graduate students would have the opportunity to interact amongst themselves and with faculty, ORC organized a biweekly luncheon series. The discussions were given by both students and faculty of the ORC and covered a wide range of topics from research areas to professional development.
- Lunch with the ORC codirectors—there were six informal luncheons in which a wide range of issues were discussed including, but not limited to, improvement of the appearance of the ORC and making the ORC and profession more visible to the MIT community.
- Women of OR Socials—informal social gatherings with all of the female graduate students and ORC-affiliated female faculty. The purpose of these events was to bring the small OR community of females together in a social setting to discuss matters of importance to women in OR.

The funding awarded for these initiatives ended in May 2006. We have requested additional funding from the Graduate Student's Office with the hopes of expanding these efforts into the upcoming academic year.

The ORC Seminar Series was privileged to have many distinguished speakers from industry and academia this year. Among the many operations research professionals who made presentations were: Pinar Keskinocak (Georgia Tech), Ioana Popescu (INSEAD), Costis Maglaras (Columbia University), Petar Momcilovic (University of Michigan), Erol Pekoz (Boston University), David Parkes (Harvard University), Marshall Fisher (University of Pennsylvania), Jean-Philippe Vial (University of Geneve), Stephen Chick (INSEAD), Murali Kodialam (Bell Labs), Retsef Levi (IBM), Thomas Bortfeld (Massachusetts General Hospital), Kourosh Eshghi (Sharif), Irvin Lustig (ILOG), Edward

Kaplan (Yale University), Ward Whitt (Columbia University), Lisa Fleischer (IBM), and Stephen Boyd (Stanford University).

ORC also offered a program of activities during the January independent activities period, including a series of presentations on the practice of operations research and management science presented by Dan Frey (MIT), Gina Mourtzinou (River Source Investments), Olivier de Weck (MIT), and Aharan Ben Tal (Technion).

Operational Issues

During AY2006, ORC experienced significant administrative changes. Both Professors James Orlin and John Tsitsiklis stepped down as codirectors. A committee was formed by associate provost Alice Gast to search for new leadership for the ORC. Professor Cynthia Barnhart and Professor Dimitris Bertsimas were selected as the new codirectors, effective July 2006.

Future Plans

The ORC program is currently in a stable condition, and does not face any unusual challenges. Still, there are a number of issues that were identified in the course of this year's strategic planning exercise, which will be explored. These include:

- New, but important application domains
- Increasing diversity and representation of minorities
- Ensuring the continued ability to support graduate students
- Possible changes in the master's program
- Relations with the Engineering Systems Division
- Visibility of the program
- External activities

ORC has established an operational partnership with the newly established Computation for Design and Optimization program by providing space and logistical support for that program. A closer form of partnership is under discussion.

Diversity

ORC has always attempted to provide an environment that is responsive to the varied professional and personal needs of the OR community at MIT, and that builds upon diversity.

The staff of ORC is comprised of two support-staff members and one administrative officer. Of these three staff, two are women, and one is African American. Four of the affiliated ORC faculty are women. The ORC makes no faculty appointments.

As for the student population, eleven of our current graduate students are women and one doctoral student is from an underrepresented minority.

Over the past years, we have made efforts to attract qualified women and underrepresented minorities to our graduate programs by targeting information to math departments in liberal arts colleges and by sending information to historically black colleges. We intend to continue these pursuits and look for other targets of opportunity for increasing diversity at ORC.

Professional Activities

Cindy Barnhart was the cowinner of the Women in Operations Research and Management Sciences Award for the advancement of women in OR/MS in recognition of her contributions toward improving the environment for women in our field and for her own professional success.

Gabriel Bitran received the Manufacturing and Service Operations Management (MSOM) Distinguished Service Award.

Oli de Weck was awarded the Frank E. Perkins Award.

Rob Freund received an Award for Excellence in Teaching at the Sloan School.

Michel Goemans was named the Robert E. Collins Distinguished Scholar in the Math Department.

Steve Graves was elected as an Institute for Operations Research and the Management Sciences Fellow. Also, Steve was cowinner of the INFORMS Case Competition. Dick Larson was named Franz Edelman Laureate.

Pablo Parrilo received the 2005 Society for Industrial and Applied Mathematics Activity Group on Control and Systems Theory Prize, awarded every three years to a young researcher for outstanding research contributions to mathematical control and systems theory.

Devavrat Shah was a cowinner of the George B. Dantzig Dissertation Award for his thesis titled "Randomization and Heavy Traffic Theory: New Approaches for Design and Analysis of Switch Algorithms."

Alexandre Belloni, an ORC student, was awarded the 2006–2007 IBM Herman Goldstine Postdoctoral Fellowship in Mathematical Sciences.

David Brown, an EECS doctoral student of Dimitris Bertsimas, won the second prize in the George E. Nicholson competition for best student paper.

Tim Chan, an ORC student, won the Canadian Operational Research Society Student Paper Competition for his paper "A Robust Approach to IMRT Optimization."

David Czerwinski, an ORC student, received a Teaching Assistant of the Year award from the MIT Sloan School of Management.

Juliane Dunkel, an ORC student, was awarded an Ida Green Fellowship for graduate studies.

Michael Metzger, an ORC student, received a Teaching Assistant of the Year award from the MIT Sloan School.

Guillaume Roels, an ORC student, received second prize in the MSOM competition for best student paper for his paper on “The Price of Information: Inventory Management with Limited Information About Demand.”

Elaine Chew, an ORC alum, received the Presidential Early Career Award for Scientists and Engineers in recognition for her research on performer-centered approaches to computer-assisted music making, and for her efforts to integrate research and education at the intersection of music and engineering.

Marshall L. Fisher, an ORC alum, received the Philip McCord Morse Lectureship Award. Garrett van Ryzin and Kalyan T. Talluri, ORC alums, received the Frederick W. Lanchester Prize for best contribution to operations research and the management sciences for their book *The Theory and Practice of Revenue Management*.

Ping Xu, an ORC alum, received second prize in the MSOM competition for best student paper for her paper on “The Benefits of Re-Evaluating the Real-Time Fulfillment Decisions.”

James B. Orlin, Codirector and Edward Pennell Brooks Professor of Operations Research
John N. Tsitsiklis, Codirector and Professor of Electrical Engineering and Computer Science

More information about the Operations Research Center can be found at <http://web.mit.edu/orc/www/>.