

Operations Research Center

The Operations Research Center (ORC), established in 1953 as a first-of-a-kind interdepartmental graduate degree program, completed its 54th year of operation in 2006–2007. 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 AY2006–2007 activities and briefly reviews its educational, research, and outreach programs.

Faculty, Students, Staff

During AY2006–2007, 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 ORC. Professors Cynthia Barnhart and Dimitris Bertsimas were selected as the new codirectors, effective July 2006.

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

Numerous affiliated faculty members joined ORC this year: Hamsa Balakrishnan (Aero/Astro), Dimitris Bertsekas (EECS), Michael Braun (Sloan), Victor Chernozhukov (Sloan), Vivek Farias (Sloan), Eytan Modiano (Aero/Astro), and John Wyatt (EECS).

ORC offers two interdepartmental graduate degree programs, a PhD and a master's degree. During the past year, these programs enrolled 54 students—41 PhD candidates, and 13 SM candidates. ORC conferred six master's degrees and six PhDs. Several other PhD theses were in the final stages of completion in summer 2007.

Academic Programs

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 one faculty member supervising a student's thesis to 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; queuing theory, including queuing 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, risk analysis and network design in air transportation, telecommunication network design, supply chain management, production scheduling, and transportation logistics.

Several organizations sponsored research projects at ORC during 2006–2007, 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, the Singapore/MIT Alliance Program, and Verizon.

Outreach and Professional Service

Annual Conference

ORC launched a new tradition of an annual conference in May, motivated by significant societal problems. The purpose of the conference was to select a theme (to change annually) and initiate a new scientific dialog on it, present new approaches and results, and improve the state-of-the-art in the selected theme. The first such conference took place on May 23, 2007 and the topic was Operations Research in Healthcare. The all-day conference consisted of a number of plenary speakers and a keynote speaker, Robert Langer, from MIT. This year's conference attracted approximately 100 attendees. Specific details on the conference can be obtained by visiting the conference website at <http://www.pumba.mit.edu/>.

Faculty Luncheons

ORC began a new tradition in which the faculty met for lunch every second Thursday throughout the academic year. The purpose of these luncheon meetings was to strengthen the sense of community among ORC faculty and afford them the opportunity to exchange ideas about important initiatives that ORC might undertake during the year.

Distinguished Seminar Series

ORC has initiated a new tradition of inviting a very senior person in the field of operations research to spend two weeks at MIT and interact with our faculty and students. Our first distinguished speaker was Professor Christos Papadimitriou from the University of California, Berkeley.

The ORC Seminar Series was privileged to have many distinguished speakers from industry and academia this year. The operations research professionals who made

presentations included Barry Smith (SABRE Holdings), Vijay Vazirani (Georgia Tech), Mihalis Yannakakis (Columbia), Saul Gass (University of Maryland), Fernando Bernstein (Duke), Daniel Bienstock (Duke), Feryal Erhun (Stanford), Adrian Lewis (Cornell), Yannis Paschalidis (Boston University), Seyed Iravani (Northwestern), Rene Caldentey (NYU), Assaf Zeevi (Columbia), Paat Rusmevichientong (Cornell), Baris Ata (Northwestern), Sridhar Seshadri (NYU), Maurice Queyranne (University of British Columbia), Dorit Hochbaum (UC Berkeley), Bruce Tidor (MIT), Baruch Schieber (IBM), and Jan Van Mieghem (Northwestern).

ORC also offered, during January independent activities period, a half-day session titled "Entrepreneurship in Operations Research." Speakers were Yossi Sheffi (cofounder of PTCG, LogiCorp, e-Chemicals, and Synkra Software, and founder of Logistics.com), Professor Cyrus Mehta (cofounder and president, Cytel Software Corporation), and Andrew Lo (founder and chief scientific officer of AlphaSimplex Group).

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 over the last year, which we will need to explore into the future. These include:

- Identifying new, but important application domains for operations researchers;
- Ensuring the continued ability to support graduate students;
- Evaluating possible changes in the master's program;
- Publishing an ORC newsletter;
- Raising funds for ORC's newly established Future Fund and Fellowship Fund;
- Developing distance education capabilities in a new distance education room;
- Renovating ORC to create student office space; and
- Conducting a survey of statistics courses at MIT.

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 diversity.

The staff of ORC is comprised of two supportstaff members and one administrative officer. Of these three staff, two are women, and one is African American. During the past year, Hamsa Balakrishnan, professor in Aeronautics and Astronautics, joined ORC as an affiliated faculty member. The ORC now has five women as affiliated faculty. ORC makes no faculty appointments.

As for the student population, 13 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. Our efforts included visiting the Undergraduate Women's Mathematics Association and the Undergraduate Mathematics Club at Dartmouth College and giving a seminar titled "What is Operations Research?" We intend to continue these pursuits and look for other targets of opportunity for increasing diversity at ORC.

Professional Activities

Cynthia Barnhart was elected as the president-elect of INFORMS.

Michael Braun received the Best Student Paper award from the Institute for Operations Research and the Management Sciences (INFORMS) Decision Analysis Society.

Robert Freund received the Jamieson Prize for Excellence in Teaching, May 2007. The Jamieson Prize is awarded for innovative contributions to teaching.

David Gamarnik received an IBM Faculty Award in June 2006.

Stanley Gershwin's paper (coauthored with Yun Kang) "Information Inaccuracy in Inventory Systems: Stock Loss and Stockout," was awarded the Best Paper of the Year in *IIE Transactions on Design & Manufacturing*.

Michel Goemans received the John Simon Guggenheim Memorial Foundation fellowship for July 2007 to June 2008.

John Hauser was elected as an INFORMS Fellow. "The Fellow Award recognizes members who have made significant contributions to the advancement of operations research and the management sciences, such contributions including service to the professional field and to INFORMS."

Richard Larson received an IBM Research Award, September 2006.

Thomas Magnanti's paper "Strong Formulations for Network Design Problems with Connectivity Requirements" (with S. Raghavan) received the Glover-Klingman Prize for the best paper published in the journal *Networks* during 2005.

Amedeo Odoni received an honorary PhD in Management Science from the Athens University of Economics and Business, October 16, 2006. In addition, he received the Maseeh Excellence in Teaching Award, MIT Civil and Environmental Engineering Department, May 2007. Moreover, Amedeo was the recipient of the Capers (1976) and Marion McDonald Award for Excellence in Mentoring and Advising, MIT School of Engineering, May 2007.

James Orlin was selected to be a MacVicar Fellow in March 2007. "Appointment as a Fellow recognizes faculty who have made exemplary and sustained contributions to the teaching and education of undergraduates at MIT." In addition, Jim was elected as an INFORMS Fellow in November 2006. "The Fellow Award recognizes members who have made significant contributions to the advancement of operations research and the

management sciences, such contributions including service to the professional field and to INFORMS.”

Andreas Schulz received an honorable mention for the INFORMS Transportation Science and Logistics Society Best Paper Award for his paper “Selfish Routing in Capacitated Networks,” (coauthored with J.R. Correa and N.E. Stier Moses), published in *Mathematics of Operations Research*.

David Simchi-Levi also was elected as an INFORMS Fellow. “The Fellow Award recognizes members who have made significant contributions to the advancement of operations research and the management sciences, such contributions including service to the professional field and to INFORMS.”

John Tsitsiklis was elected to the National Academy of Engineering for “his contributions to the theory and application of optimization in dynamic and distributed systems.” In addition, John was appointed the Clarence J Lebel Professor of Electrical Engineering.

Timothy Chan, an ORC student, was awarded the Hugh Hampton Young Memorial Fund Fellowship.

Juliane Dunkel, an ORC student, received the Diploma Thesis Award of the German Association of Operations Research, 2006.

Hamed Mamani, an ORC student, received the INFORMS Pierskalla best paper award, November 2006. Hamed also received an honorable mention in the INFORMS Bonder Scholarship.

Michael Metzger was awarded the Goodwin Medal for Outstanding Teaching Assistant of the year for MIT. Its purpose is to recognize a “conspicuously effective” young teacher who is also a graduate student.

Alex Rikun, an ORC student, received an honorable mention from the National Science Foundation, March 2007.

Stephen Shum, an ORC student, received an honorable mention in the Nicholson Student Paper Competition for “Coordinating Efforts of Multiple Retailers in a Decentralized Supply Chain,” November 2006.

Alexandre Belloni received second place in the Nicholson Student Paper Competition for his paper “On the Computational Complexity of MCMC-based Estimators in Large Samples.”

Vijay Chandru received the INFORMS President’s Award. The purpose of this award is to recognize, and thereby encourage, important contributions to the welfare of society by members of our profession at the local, national, or global level.

Marshall Fisher was awarded the Philip McCord Morse Lectureship Award, in honor of Philip McCord Morse, in recognition of his pioneer contribution to the field of operations research and the management sciences.

Garrett J. van Ryzin was the recipient of the Distinguished Service Award for his meritorious service towards advancing the goals and objectives of the Manufacturing and Service Operations Management Society of INFORMS.

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