

## **Computation for Design and Optimization**

Academic year 2007 marked the second fully operational year of MIT's new master's of science program in Computation for Design and Optimization (CDO). During this period, the program continued to expand the number of students, affiliated faculty, and program-related activities. The program conducted its first independent activities period (IAP) session, sponsored its second Distinguished Speaker Series, and administered its third admissions cycle. The roster of CDO-affiliated faculty members, representing nine departments, increased to 29. Of the first 17 students admitted to the program in 2005, 12 graduated in September 2006, and three graduated in June 2007. Fourteen students from the first two admitted groups are on the September 2007 degree list, and 23 new students will begin their CDO studies in September 2007. The program continued to operate under a temporary administrative structure in temporary office space, while pursuing permanent administrative and space solutions.

### **Premise for the CDO Program**

Intensive computation for design and optimization is now an essential activity in the design and operation of many complex engineered systems, from micro-machined devices, guidance/control systems, imaging systems, and distribution networks to telecommunications and transportation systems. The critical role that computation plays across all engineering disciplines, in both academia and industry, has created a clear need to educate tomorrow's engineers in computational science for design and optimization. The CDO interdepartmental master's degree program addresses this need by educating students in the formulation, analysis, and critical application of computational approaches to designing, predicting, controlling, and optimizing engineered systems. Graduates of the CDO program learn the interdisciplinary tools needed to model, optimize, control, and operate the important engineered systems of the next decade and beyond.

### **Current Goals**

The CDO program's goals for the upcoming year include:

- Establishing a mechanism whereby CDO graduates qualify for doctoral study in select departments at MIT
- Developing a permanent administrative structure: space, staffing, and reporting
- Fostering community among CDO-affiliated faculty and students
- Expanding the outreach of CDO at MIT and elsewhere
- Securing non-SMA (Singapore-MIT Alliance) sources of funding for students and affiliated faculty

## Accomplishments

### Admissions

Of 100 applications submitted to CDO for AY2008 admission, 37 students were admitted, 23 accepted our admissions offer, and three deferred admission to 2008. In addition to the new students, CDO will have seven continuing students entering their second year of the program, and three dual-degree candidates simultaneously pursuing PhDs in other MIT departments. In all, the CDO program will have 33 students in September 2007. Four of our 16 CDO graduates are or will become doctoral students at MIT.

### Research Support and SMA-2

In 2005, CDO was awarded a five-year collaborative research and education program grant through the Singapore–MIT Alliance (SMA-2), working alongside colleagues from the National University of Singapore. As CDO enters its third year of the grant period, the program and CDO-affiliated faculty continue to receive approximately \$1.8 million per year in research funding from SMA-2.

The educational adjunct to this SMA-sponsored research support is composed of a two-year dual-degree program in computational engineering (CE), in which students are awarded both a CDO master's degree from MIT and a CE master's degree from the National University of Singapore. Up to 16 SMA fellowships per year are available for CDO students through the SMA-CE program. Of the 18 students who enrolled in CDO in AY2007, 11 received SMA fellowships. Fourteen of the 23 new CDO students entering in September 2007 are recipients of SMA fellowships. In AY2008, CDO-CE students will, for the first time, be in residence at MIT for a full year. In previous years, these students spent one semester plus a summer at MIT.

## Initiatives

### CDO Student and Faculty Environment

CDO program activities are intended to establish a productive, collegial environment for students and faculty. For CDO students, this year we conducted a fall program orientation, held several lunches for students to meet with the CDO codirectors, hosted a formal winter reception for students and faculty as well as a celebration for our first June graduates, conducted our first CDO IAP offering, and encouraged student involvement in Graduate Student Association events and activities.

For faculty, we held regular faculty meetings to discuss emerging program issues and common interests, convened the CDO steering committee (composed of six CDO-affiliated faculty members) once per semester to discuss strategic matters and future directions of the program, and established two new faculty committees in an effort to further develop and promote the program, including a doctoral committee, whose mission is to explore the establishment of a CDO PhD, and an outreach committee, charged with focusing on internal and external program publicity. We continue to

believe that the program, which currently engages 29 affiliated faculty from across the Institute, has the potential to involve significantly more MIT faculty members.

### **Distinguished Speaker Series**

CDO sponsored the second year of its Distinguished Speaker Series, in which five world-renowned researchers presented their latest research on topics relevant to computation for design, control, simulation, and optimization. These seminars are free and open to the public; streaming videos of the lectures are available on the CDO website. We plan to continue the series throughout the coming years.

### **Publicizing CDO**

This past year, CDO undertook several new publicity and marketing activities in an effort to promote the program at MIT and other universities. In January, we held the first CDO IAP offering, led by faculty and students and designed to disseminate information about the program to the MIT community. The CDO codirectors made a presentation about the program to the Engineering Council in March. We increased the number of dual-degree MIT students enrolled in CDO by asking faculty to encourage those PhD students whose interests align with the educational content of CDO to concurrently pursue the CDO SM degree. CDO-affiliated faculty who spoke at the annual Society for Industrial and Applied Mathematics conference in January disseminated information about the program, and we participated in diversity recruiting at the American Society of Black Engineers in March through the MIT Graduate Students Office diversity coordinator. Of interest to prospective students, the master's theses of many of our CDO alumni have been added to the CDO website alumni page. We also listed the program in *Peterson's Guide* and on other relevant graduate program informational websites. The outreach committee plans to continue and expand on these activities in AY2008.

### **Finances and Funding**

The CDO program and its affiliated faculty continue to receive \$1.8 million per year in research funding through SMA-2. We expect this funding to continue through 2010. Also, in late July 2007, a group of MIT faculty will submit a proposal to the Department of Energy's National Nuclear Security Administration, in response to the Predictive Science Academic Alliance Program's call for proposals to set up a multidisciplinary simulation center to predict material response under extreme loading. An important aspect of this proposal is its educational component, which would be addressed by the CDO program.

### **Personnel Information**

The CDO codirectors are Professor Robert Freund (Sloan School of Management) and Professor Jaime Peraire (Department of Aeronautics and Astronautics). Laura Koller is the CDO program administrator and is responsible for graduate student support, admissions, and communications.

CDO currently has 29 affiliated faculty. We hope to expand this number during the coming year.

**Robert M. Freund**

**Codirector and Theresa Seley Professor of Management Sciences**

**Jaime Peraire**

**Codirector and Professor of Aeronautics and Astronautics**

*More information about the Computation for Design and Optimization program can be found at <http://web.mit.edu/cdo-program/>.*