

## Computation for Design and Optimization

The inaugural cohort of master's degree students in the program in Computation for Design and Optimization (CDO) started their academic program in fall 2005, roughly 10 months after the interdepartmental master of science program in CDO was approved by the MIT Faculty. During this past academic year, CDO secured temporary office space and administrative support, commenced its academic program, ran a variety of activities to help build a healthy environment for CDO students and affiliated faculty, conducted numerous publicity activities, sponsored a CDO Distinguished Speakers Series, and conducted its second admissions cycle. We expect 12 students to become CDO's first graduates in September 2006, and we expect 20 new students to enter the CDO program in September 2006.

### Premise for the CDO Program

Intensive computation for design and optimization has become an essential activity in both the design and operation of many complex engineered systems, from micromachined devices, guidance/control systems, imaging systems, and distribution networks to telecommunications systems and transportation systems. The critical role that computation now plays across all engineering disciplines, as well as the industry-based demand for engineers who are literate in computational sciences, has created a clear need to educate tomorrow's engineers in computational science for design and optimization. The CDO interdepartmental master's 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. Successful CDO students will model, optimize, control, and operate the important engineered systems of the next decade, as well as contribute to our own increasingly computationally intensive research programs here at MIT.

### Current Goals

Our goals include:

- Expanding the outreach of CDO at MIT and elsewhere
- Developing a permanent administrative support structure
- Finding a permanent solution to our space needs
- Securing non-Singapore-MIT Alliance funding for both students and affiliated faculty

### Accomplishments

#### Inauguration of CDO Program

We successfully inaugurated the CDO program with 17 students entering in fall 2005, and we expect to see these students graduate in either September 2006 or June 2007. We have conducted our academic, administrative, and educational activities in our first year with no significant problems.

## Admissions

Of the 115 applications that CDO received during its second admissions cycle, 40 students were admitted, 20 students accepted our offer of admission and will enter the program in September 2006, and 2 deferred admission to 2007.

## Research Support and SMA-2

CDO applied for and was awarded a collaborative research and educational program grant through the Singapore–MIT Alliance (SMA-2) with colleagues from the National University of Singapore. On the research side, the CDO program and CDO–affiliated faculty receive approximately \$1.8 million per year from SMA-2 for the five-year period that began in our first academic year. The educational component is comprised of a two-year dual degree program in computational engineering (CE), wherein students who are accepted and enrolled in CE are awarded a CDO master’s degree from MIT and a CE master’s degree from the National University of Singapore. Up to 16 SMA fellowships are available for CDO through the SMA CE program. Of the 17 students who enrolled in CDO in September 2005, 12 were recipients of these SMA fellowships, and 11 of the 20 students enrolling in CDO in September 2006 are recipients of SMA fellowships.

## Initiatives

### CDO Student and Faculty Environment

We developed and ran a number of activities this year to engender a healthy environment for CDO students and affiliated faculty. For students, we held a fall term orientation, hosted several lunches with the codirectors, held a formal reception for students and faculty, and facilitated student involvement in Graduate Student Association events and activities. For faculty, we held regular faculty meetings to discuss emerging issues and outline common interests, and we convened the CDO Steering Committee, (comprised of six CDO–affiliated faculty members) once each semester to discuss current issues and the future direction of the program. One of our principal efforts is aimed at publicizing the program both within and outside of MIT. Within MIT, we feel that the program, which currently engages 26 affiliated faculty from across the Institute, has the potential to involve two to three times as many faculty members.

### Distinguished Speakers Series

During its inaugural year, CDO sponsored a Distinguished Speakers Series in which seven world-renowned researchers presented their latest research on topics relevant to computation for design, control, simulation, and optimization. We plan to continue this seminar series this coming year and beyond.

### Publicizing CDO

CDO has developed publicity and marketing plans to promote the CDO program both at MIT and at other universities. To accomplish this, we produced a two-color brochure, expanded and updated the CDO web site, wrote articles for *TechTalk* and the MIT Faculty Newsletter, placed print advertisements in professional journals, and

produced a large direct mailing to relevant faculty, deans, and department heads at other universities both in the United States and abroad. We plan to continue and expand these activities in FY2007.

### **Finances and Funding**

As noted above, the CDO program and its affiliated faculty receive approximately \$1.8 million per year in research funding through SMA-2. We expect this funding to continue through 2010. To ensure longer-term sustainability, it is imperative that CDO develop other sources of funding. We are taking an active role within the Institute to identify and apply for large interdisciplinary research programs. Most recently, we submitted a white paper 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 communications and graduate admissions coordinator. Laura Rose provides administrative, secretarial, and general program support for CDO.

CDO currently has 26 affiliated faculty. We hope to expand this to 35–40 affiliated faculty in the coming year.

**Robert M. Freund, Codirector and Theresa Seley Professor of Management Science**  
**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/>.*