California Institute of Technology

Graduate Program in Control and Dynamical Systems

Caltech's Control and Dynamical Systems (CDS) program offers an interdisciplinary Ph.D. program that provides rigorous training in mathematics, dynamics, and control, coupled with intensive study of application areas in science and engineering. The program offers a unique combination of analytical, computational, and experimental activities, and connects to diverse research across the Caltech campus.

Students in the CDS program are expected to have exceptional analytical capabilities, combined with solid domain knowledge in at least one application area. The first year curriculum strengthens mathematical capabilities through courses in linear operator theory and differential geometry, combined with a sequence of courses in dynamical systems and feedback control. All CDS students are additionally required to take graduate level courses in an application area relevant to their thesis research.

Students in CDS can work with any faculty member at Caltech, and are strongly encouraged to explore new areas of research where CDS principles and tools are relevant. Joint advising among multiple faculty is common. Several CDS courses are offered to help students explore new application domains and to bring together CDS students with faculty and students in Biology, Physics, Computer Science, Communications, Environmental Science, and other areas.

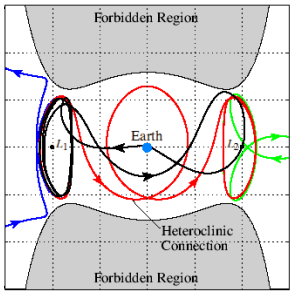
There are currently 20 graduate students enrolled in the program, along with approximately 10 postdocs and 6 visitors (long and short term). The program has graduated over 25 Ph.D. students since 1996, with about half in academia (including ETH, Georgia Tech, Maryland, Penn, Stanford and UIUC).

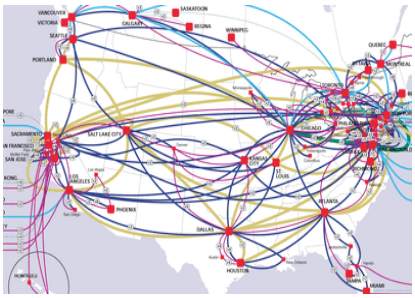
<u>CDS Faculty</u>

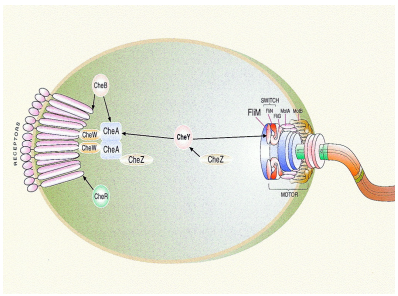
John Doyle (Professor)
Hideo Mabuchi (Associate Professor)
Doug MacMartin (Senior Research Fellow)
Jerrold Marsden (Professor and Option Rep)
Richard Murray (Professor)
Mark Myers (Visiting Associate; UTRC)
Jeff Shamma (Visiting Associate; UCLA)
Martin Lo (Visiting Associate, JPL)

<u>Affiliated faculty</u>

Joel Burdick (Mechanical Engineering)
Fred Culick (Mechanical Engineering)
Babak Hassibi (Electrical Engineering)
Steven Low (Computer Science, Electrical Eng)
Pietro Perona (Electrical Engineering)
Thanos Siapas (Computational & Neural Systems)
Tapio Schneider (Environmental Science and Eng)
Michael Dickinson (Bioengineering)







http://www.cds.caltech.edu

Additional Information

Applying to CDS

Applications are sought from exceptional candidates with interdisciplinary interests. Successful applicants will generally have strong preparation in mathematics and research experience at the undergraduate or masters level. Students with low (sub-90th percentile) GRE analytical and quantitative scores, or with only a traditional engineering mathematics background, are generally not competitive for admissions.

Applications are due no later than 15 January of each year, with early submission recommended. Applicants who are considered highly qualified will be invited to interview at Caltech in late February. Final decisions on admissions are made by 15 March. Admissions rates are typically 5%; Ph.D. completion rates are approximately 90%. All accepted students are provided full financial aid for the duration of their studies (subject to satisfactory progress towards their Ph.D.).

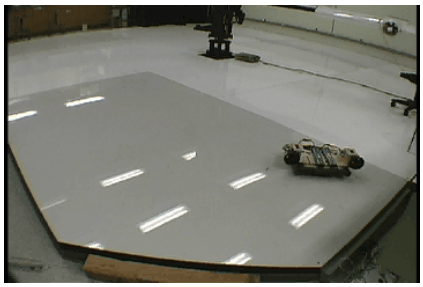
A limited number of students are admitted for a two-year MS degree. This degree is considered a terminal degree and admission to the Ph.D. program requires re-application. Admission to the MS program is highly competitive and does not include financial aid. Students pursuing an MS degree are required to complete all Ph.D. coursework as well as a substantial project.

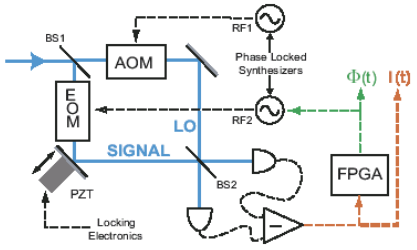
Research Areas

Faculty and students in CDS are active in a number of research areas. The primary theoretical areas of research include robust control, multivariable and nonlinear dynamical systems, multiscale modeling, optimal and decentralized control, system identification and estimation theory, and communications and information theory. Applications include mixing and transport processes in fluids, cooperative control of multi-vehicle systems, networking and communication systems, biological systems, quantum measurement and control, control of nonlinear and mechanical systems, nonlinear and chaotic dynamics, mechanics, nonlinear flight dynamics for highly maneuverable aircraft, and robotics.

Selected, active multi-investigator projects

- Software Enabled Control (DARPA)
- Institute for Quantum Information (NSF)
- Quantum Communication Networks (MURI)
- Mixed Initiative Control of Automa-teams (DARPA)
- Cooperative Control (MURI)
- Integrated Computing, Communications, and Control (AFOSR)
- Systems Biology (JSF, NIH)
- Center for Multiscale Modeling and Simulation (CIT, NSF)
- Adaptive Ocean Sampling Network (ONR)





http://www.cds.caltech.edu