

# SEMINAR NOTICE

Department of Electrical and Systems Engineering

**2009 Zaborszky Distinguished Lecture Series**

**Dates and Time: 10-12 noon, Monday-Wednesday, Sept. 21-23, 2009**

**Venue: Room 322, Rebstock Hall, Danforth Campus**

**Speaker: Professor Andrew R. Teel, PhD**

**Department of Electrical and Computer Engineering, University of California, Santa Barbara**

**Title: Hybrid Dynamical Systems: Modeling, Stability, and Control (a short course in three parts)**

**Abstract:**

A bouncing ball, a network of impulsive biological oscillators, a sampled-data and networked control system, and a supervisory-based feedback control loop are examples of hybrid dynamical systems. These systems contain variables that, in some regions of the state space, change continuously and, in other regions, change instantaneously. Hybrid systems have been studied extensively over the last two decades, with important contributions generated by computer scientists, mathematicians, and control engineers. Interest from the control community is due, primarily, to the recognition that advances in modeling and analysis of hybrid systems may spawn a variety of novel feedback control ideas.

This series of lectures emphasizes a dynamical systems approach to hybrid systems. The first lecture describes a modeling framework and a set of structural properties under which the dynamic behavior of a hybrid system is robust. Robustness means that small perturbations to the system lead to correspondingly small changes in the qualitative behavior of the system. This feature is a requirement for feedback control systems of all types, including hybrid control systems. Moreover, the properties that yield robustness also confer to hybrid systems many classical stability analysis tools from continuous-time and discrete-time nonlinear systems. Stability analysis for hybrid systems is the focus of the second lecture. We will cover Lyapunov theorems, invariance principles, and other hybrid-specific stability analysis tools. These tools serve as the genesis for several novel hybrid feedback control ideas. The third lecture covers the use of hybrid feedback to solve a variety of challenging nonlinear control problems.

**Biography:**

Andrew R. Teel received the A.B. degree in engineering sciences from Dartmouth College in 1987, and the M.S. and Ph.D. degrees in electrical engineering from the University of California, Berkeley, in 1989 and 1992, respectively. After receiving the Ph.D., he was a postdoctoral fellow at the Ecole des Mines de Paris in Fontainebleau, France. From 1992 to 1997 he was a faculty member in the Electrical Engineering Department at the University of Minnesota. In 1997, he joined the faculty of the Electrical and Computer Engineering Department at the University of California, Santa Barbara, where he is currently a professor. He has received NSF Research Initiation and CAREER Awards, the 1998 IEEE Leon K. Kirchmayer Prize Paper Award, the 1998 George S. Axelby Outstanding Paper Award, and the SIAM Control and Systems Theory Prize in 1998. He was the recipient of the 1999 Donald P. Eckman Award and the 2001 O. Hugo Schuck Best Paper Award, both given by the American Automatic Control Council. He is a Fellow of the IEEE.