Workshop on: "Switching in Systems and Control"

Featured main speaker:

Prof. Daniel Liberzon
Coordinated Science Laboratory
University of Illinois at Urbana-Champaign

Additional speaker, and workshop organizer:

Dr. Michael Margaliot
School of Electrical Engineering
Tel-Aviv University

Monday, June 1, 2009
Daniel Hotel, Herzlia

Description:
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Switched and hybrid systems provide suitable mathematical models for numerous real world systems ranging from electrical circuits to Internet protocols. Switched systems also arise naturally in control schemes that employ switching between several possible controls laws, which are ubiquitous in adaptive, networked and optimal control.

This tutorial workshop will examine switched systems from a control-theoretic perspective. The main focus will be on stability analysis and control synthesis of systems that combine continuous dynamics with switching events.

We will start with an introduction to the basic concepts and definitions for hybrid and switched systems. In the analysis part of the workshop, we will develop stability theory for switched systems. Here we will cover single and multiple Lyapunov function methods, stability criteria based on commutation relations, stability under slow switching, and stability of switched systems with useful special structure. Properties beyond traditional stability, such as response to external inputs, will also be mentioned.

In the design part of the workshop, we will discuss systems for which the logic-based switching paradigm emerges naturally as a control design tool. Specific classes of interest include systems with sensor or actuator constraints (such as quantized feedback systems) and systems with large modeling uncertainty (for which we will present switching adaptive control techniques). More details about the program will be distributed at a later stage.

The bulk of the workshop will be presented by Prof. Liberzon.

Dr. Margaliot will present a tutorial on the stability analysis of switched systems using optimal control techniques.

The workshop language is English.

Schedule
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08:30-09:00 Registration

09:00-09:10 Opening Remarks

09:10-10:30 Session 1:   Introduction to switched systems
                               Stability under arbitrary switching

10:30-11:00 Coffee break

11:00-12:20 Session 2:   Stability under constrained switching
                               Switched systems with inputs and outputs

12:20-14:00 Lunch break

14:00-15:15 Session 3:   An overview of applications
                               Stability analysis using the variational approach

15:15-15:45 Coffee break

15:45-17:30 Session 4:   Control with limited information
                               Switching adaptive control

Bio Sketch for Prof. Liberzon:
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Daniel Liberzon was born in the former Soviet Union on April 22, 1973. He was a student in the Department of Mechanics and Mathematics at Moscow State University from 1989 to 1993 and received the Ph.D. degree in mathematics from Brandeis University in 1998 (under the supervision of Prof. Roger W. Brockett of Harvard University). Following a postdoctoral position in the Department of Electrical Engineering at Yale University from 1998 to 2000, he joined the University of Illinois at Urbana-Champaign, where he is now an associate professor in the Electrical and Computer Engineering Department and the Coordinated Science Laboratory.

He is the author of the book Switching in Systems and Control Birkhauser, 2003) on which this workshop is based (supplemented with several more recent Results). Dr. Liberzon received the IFAC Young Author Prize and the NSF CAREER Award, both in 2002, and the Donald P. Eckman Award from the American Automatic Control Council in 2007.

Dr. Liberzon's research interests include nonlinear control theory, analysis and synthesis of

switched systems, control with limited information, and uncertain and stochastic systems.