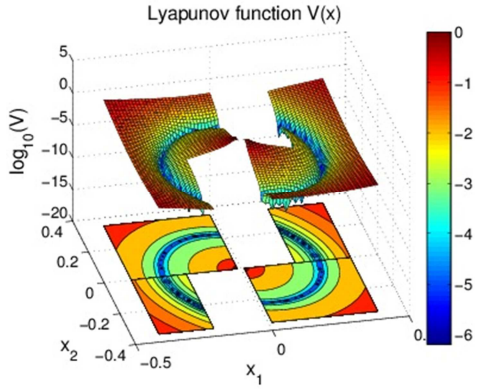
UNIVERSITY OF TRENTO - Italy
Department of Industrial Engineering

On the asymptotic stability assessment of compact sets in hybrid systems using weak Lyapunov functions

Andrew Teel
University of California, Santa Barbara

First Seminar: May 6th, 2016, h: 9:30 - 12:00

Department of Industrial Engineering
Room n. 211, via Sommarive 9, Povo - Trento



Abstract: In this series of meetings and seminars, we will provide an extensive overview of some recently developed techniques for studying the asymptotic stability of compact attractors for hybrid dynamical systems by constructing different forms of Lyapunov functions. Lyapunov functions are called "strong" whenever they are positive definite with respect to the attractor and strictly decreasing outside the attractor itself. For several first-principles-inspired Lyapunov functions (like the total energy of a mechanical systems), these properties are rarely met in practice, so that it is very convenient to resort to “weakened" Lyapunov conditions.
Examples of techniques that are compatible with weak Lyapunov functions are the well known invariance principle, as well as constructions like nested Matrosov functions. Additional relaxations of the classical Lyapunov conditions can be also obtained by not requiring the typical differentiability assumption but resorting to Lipschitz-only functions or even lower semicontinuous functions. Many of these relaxations will be covered during this seminar and different applications where they are a useful tool for stability assessment will be discussed.

Biosketch: Andrew R. Teel (S’91–M’92–SM’99–F’02) received the A.B. degree in engineering sciences from Dartmouth College, Hanover, NH, in 1987, and the M.S. and Ph.D. degrees in electrical engineering from the University of California, Berkeley, in 1989 and 1992, respectively. He then became a postdoctoral fellow at the Ecole des Mines de Paris, Fontainebleau, France. In 1992, he joined the faculty of the Electrical Engineering Department, University of Minnesota, where he was an Assistant Professor until 1997. Subsequently, he joined the faculty of the Electrical and Computer Engineering Department, University of California, Santa Barbara, where he is currently a Professor. His research interests are in nonlinear and hybrid dynamical systems, with a focus on stability analysis and control design. Dr. Teel received the NSF Research Initiation and CAREER Awards, the 1998 IEEE Leon K. Kirchmayer Prize Paper Award, the 1998 George S. Axelby Outstanding Paper Award, and was the recipient of the first 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, and also received the 2010 IEEE Control Systems Magazine Outstanding Paper Award. He is an area editor for Automatica, and a Fellow of IFAC.