

EECI-HYCON2 Graduate School on Control

www.eeci-institute.eu/GSC2012

Spring 2012

18 INDEPENDENT MODULES – one 21 hours module per week (3 ECTS)

Deadline for ADVANCE REGISTRATION to each module: 16/12/2011

*****Limited seating: register as soon as possible*****

Locations: Supelec (South of Paris), Istanbul (Turkey), L'Aquila (Italy)

M1 30/01/2012 – 03/02/2012	<i>Advanced Control of Physical Systems Arising in Modern Technological Applications</i>	Romeo Ortega
M2 06/02/2012 – 10/02/2012	<i>Modelling, State Estimation and Vision Based Control of Aerial Robotic Vehicles</i>	Robert Mahony/ Tarek Hamel
M3 13/02/2012 – 17/02/2012	<i>Randomization in Systems and Control Design - the Scenario Approach</i>	Marco C. Campi/ Simone Garatti
M4 20/02/2012 – 24/02/2012	<i>Decentralized and Distributed Control</i>	Giancarlo Ferrari-Trecate/ Marcello Farina
M5 27/02/2012 – 02/03/2012	<i>Theory of Observers</i>	Laurent Praly
M6 05/03/2012 – 09/03/2012	<i>Introduction to Nonlinear Control</i>	Hassan Khalil
M7 12/03/2012 – 16/03/2012	<i>Backstepping Control of PDEs and Delay Systems</i>	Miroslav Krstic
M8 19/03/2012 – 23/03/2012	<i>Recent Advances of Sliding Mode Control</i>	Vadim I. Utkin
M9 26/03/2012 – 30/03/2012	<i>Regulation and Tracking for Nonlinear Systems, with Emphasis on Recent Advances and Open Problems</i>	Alberto Isidori
M10 02/04/2012 – 06/04/2012	<i>Control of Highly Nonlinear Systems</i>	Claude Samson / Pascal Morin
M11 09/04/2012 – 13/04/2012	<i>Nonlinear Controllability, Observability, and Optimal Control Problems in Robotics</i>	Antonio Bicchi
M12 30/04/2012 – 04/05/2012	<i>Quantum Control and Quantum Information Processing</i>	Roger W. Brockett
M13 07/05/2012 – 11/05/2012	<i>Hybrid Dynamical Systems: Stability and Control</i>	Andrew Teel
M14 14/05/2012 – 18/05/2012	<i>Mean Field Stochastic Systems and Control</i>	Peter E. Caines
M15 21/05/2012 – 25/05/2012	<i>Distributed Control</i>	A. Stephen Morse
Istanbul M16 16/04/2012 – 20/04/2012	<i>Controlled Synchronisation of Physical Systems</i>	Antonio Loría / Elena Panteley
Istanbul M17 23/04/2012 – 27/04/2012	<i>Optimality, Stabilization, and Feedback in Nonlinear Control</i>	Francis Clarke
L'Aquila M18 14/05/2012 – 18/05/2012	<i>Specification, Design and Verification of Distributed Control Systems</i>	Richard Murray / Ufuk Topcu

L'Aquila M18
 14/05/2012 – 18/05/2012

Specification, Design and Verification of Distributed Control Systems



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Abstract of the course:

Increases in fast and inexpensive computing and communications have enabled a new generation of information-rich control systems that rely on multi-threaded networked execution, distributed optimization, sensor fusion and protocol stacks in increasingly sophisticated ways. This course will provide working knowledge of a collection of methods and tools for specifying, designing and verifying distributed control systems. We combine methods from computer science (temporal logic, model checking, reactive synthesis) with those from dynamical systems and control (Lyapunov functions, sum-of-squares certificates, receding horizon control) to analyze and design partially asynchronous control protocols for continuous systems. In addition to introducing the mathematical techniques required to formulate problems and prove properties, we also describe a software toolbox that is designed for analyzing and synthesizing hybrid control systems using linear temporal logic and robust performance specifications.

The following topics will be covered in the course:

- * Transition systems and automata theory
- * Specification of behavior using linear temporal logic
- * Algebraic certificates for continuous and hybrid systems
- * Approximation of continuous systems using discrete abstractions
- * Verification of (asynchronous) control protocols using model checking
- * Synthesis of control protocols and receding horizon temporal logic planning
- * Case studies in autonomous navigation and vehicle management systems