PhD. SIDRA School 2016
Robust Constrained Control
Bertinoro, July 11-13, 2016

Coordinators and Lectureres:

Franco Blanchini (University of Udine)
Patrizio Colaneri (Polytechnic Univ. of Milan)

School Objectives

The primary objective of the course is to provide an updated view on the heritage and development of Lyapunov theory for stability, performance improvement and control of linear dynamical systems (in continuous-time) with uncertainties parameters and constraints on the state and/or input variables. Being the topic quite broad, the attention is limited to particular input and state constraints - for instance saturations, control energy and output shaping constraints - and particular parameters uncertainties, like norm-bounded uncertainties, polytopic uncertainties and uncertainties modelled via Markov chains.

Schedule

Monday morning 09:00—12:30
(Franco Blanchini): The basic concepts will be presented which will be used in the following lectures. In particular we will introduce the notions of Lyapunov functions, control Lyapunov function, quadratic/non--quadratic stabilizability and gradient--based control. We will in particular consider the case of linear time--varying uncertain systems.

Monday afternoon 15:00—18:30
(Patrizio Colaneri): The concept of quadratic stability will be further developed. In particular the fundamental relation with H-infinity analysis (frequency response) Riccati equations, linear matrix inequalities (LMI) will be presented together with a summary of related problems like passivity, small gain, model matching and controller parametrization.

Tuesday Morning 09:00—12:30
(Franco Blanchini): Application of Lyapunov techniques to systems with control and state constraints will be presented. Techniques for input--saturated systems, model--predictive control and relatively optimal control will be considered.

Tuesday afternoon 15:00—18:30
(Franco Blanchini): The problems of stability and stabilization of LPV systems will be analyzed along with the issue robust versus gain--scheduling control.
(Patrizio Colaneri): Control of systems with Markovian jumps.

Wednesday morning 09:00—12:30
(Patrizio Colaneri): Improving performances via parameter switching: a few applications based on non--quadratic Lyapunov functions.