PROGRAM

9:00-9:30 - Welcome

9:30-10:15 - Isabelle Queinnec and Sophie Tarbouriech (LAAS-CNRS, Toulouse)
Static Anti-Windup Design for Discrete-Time Large-Scale Saturated Synchrotron System

10:15-11:00 - Matthew Turner (University of Leicester)
Stability Analysis of Systems with Anti-Windup Compensators

11:00-11:30 – coffee break

11:30-12:15 - Andrea Beciu and Giorgio Valmorbida (L2S CentraleSupelec, Gif-sur-Yvette)
Static Anti-Windup Design for Synchronous Machines

We propose static anti-windup design strategies for non-salient synchronous machines. The anti-windup design has to account for a particular feature of these systems, which relates to the set of inputs contraints: the saturation element is non-decentralized, that is, the saturation of the two input channels are not independent. Moreover, the model of the machine includes quadratic terms which are energy-preserving. A widely adopted strategy for the control of synchronous machines is to cancel these nonlinearities with a non-linear inversion type strategy. Such a non-linearity compensation is no longer possible when the input saturates. We study the impact of the anti-windup compensator for the cases where the nominal controller is composed by PI control and a non-linear compensation and for the case with only PI control. We present and discuss a first set of experimental results.

12:15-13:00 - Christophe Prieur (GIPSA-lab, Grenoble)

13:00-14:30 - Lunch

14:30-15:15 - Gérard Scorletti (Ecole Centrale de Lyon)
Toward Nonlinear Tracking and Rejection using LPV Control

(Quasi) LPV control methods and more generally L2 gain control methods, referred to as nonlinear H infinity control methods, are usually applied in order to ensure reference tracking and disturbance rejection. In this presentation, we exhibit a counterexample that reveals that these specifications can not be ensured by these methods. We then propose a new LPV based approach in order to a priori ensure these specifications by combining the LPV method with the incremental L2 gain analysis of nonlinear performance. Its benefit is illustrated on the counterexample.

15:15-16:00 - Peter Seiler (University of Minnesota), Murat Arcak and Andrew Packard (University of California, Berkeley)
Finite Horizon Robustness Analysis of LTV Systems Using Integral Quadratic Constraints

This talk covers theoretical and computational methods to analyze the robustness of uncertain linear time-varying (LTV) systems over finite time horizons. Motivating applications for this work include robotic systems and space launch / re-entry vehicles both of which undergo finite-time trajectories. Typical notions of robustness, e.g. nominal stability and gain/phase margins, can be insufficient for such systems. Instead, this talk focuses on robust induced gains and bounds on the reachable set of states. Sufficient conditions to compute robust performance bounds are formulated using dissipation inequalities and integral quadratic constraints. The analysis conditions are provided in two equivalent forms as Riccati differential equations and differential linear matrix inequalities. A computational approach is provided that leverages both forms of the analysis conditions.

16:00-16:45 - Andres Marcos (University of Bristol)
Advanced Robust Control Design for the VEGA Launch Vehicle

This talk presents the design of a robust atmospheric control system for the rigid and flexible motions of the VEGA launcher using two robust control techniques. The first represents an augmentation of capabilities of the classical VEGA Thrust Vector Control (TVC) system via its formulation as a robust control problem framed around the structured H-infinity technique. The second uses the linear parameter varying (LPV) control design paradigm. Both techniques, and unlike the state-of-practice of independent rigid-body and bending filters designs followed by an ad hoc tuning, in this work the rigid-body controller and bending filters are first parameterized and then optimized simultaneously. This joint design simplifies the synthesis process and reduces the tuning effort prior to each launcher mission. The presented techniques are now well-known standards in robust control design theory but they have seldom been integrated and applied in a methodological manner for the control design of a complex nonlinear, high-fidelity system (in the present case the actual VEGA VV05 mission flight).