

Robust Control: A LMI Based Perspective (with Applications to Bioprocesses)

Wednesday 24 October and Friday 26 October, 2012

UMONS, Service d'Automatique, Boulevard Dolez 31, 7000 Mons

Enrollment in the course by email at vincent.moeyaert@umons.ac.be

The course aims at providing an introduction to the robust control paradigm for stability and performance analysis, and control synthesis for dynamical systems based on the linear matrix inequality (LMI) framework. To this end, the course is organized in four modules which can be separately attended depending on background knowledge of the students on the theory of dynamical systems.

Wednesday 24 (9:30-12:30) Module 1: Basic Concepts (3 hours)

- Introduction to Robust Control
- Modeling uncertain systems and Examples
- Norm of systems
- The robust stability and stabilization problem
- The performance analysis and design problem
- The filtering and state estimation problem
- Lyapunov theory and quadratic stability
- Linear matrix inequality framework: problem statement and solutions for nominal systems

Wednesday 24 (14:00-17:00) Module 2: Linear Systems (3 hours)

- Introduction
- Robust Stability and Stabilization
- Output energy and guaranteed cost control (LQR)
- H-2 analysis and control synthesis
- H-infinity and control synthesis
- H-2 and H-infinity filtering
- H-2 and H-infinity state estimation
- Some simple examples

Friday 26 (9:30-12:30) Module 3: Nonlinear Systems (3 hours)

- Introduction
- Local stability and region of attraction
- Modeling nonlinearities as time-varying parameters: the quasi-LPV approach
- Alternative representations of nonlinear systems
- Stability analysis and control design

- Some simple examples

Friday 26 (14:00-17:00) Module 4: Applications to Bioprocess control (3 hours)

- Introduction
- Case study 1
- Case study 2
- Case study 3

The course slides, simulation files of the examples and LMI coding will be available (close to the course starting) at the website:

www.das.ufsc.br/~coutinho/RobustControl.htm

For further information about the course, please contact directly the speaker at

coutinho@das.ufsc.br

Biography of the speaker:

Daniel Coutinho received the B.S. degree in Electrical Engineering in 1989 from the Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil, and the M.S. and Doctoral degrees in Electrical Engineering from the Universidade Federal de Santa Catarina (UFSC), Florianópolis, Brazil, in 1993 and 2003, respectively. He was a visiting scholar at the University of Newcastle, Australia, in 2001. From 1992 to 1997, he was a Lecturer in the Electronics Department at the Centro Federal de Educação Tecnológica de Santa Catarina (actual IFSC). From 1998-2010, he was with the Faculty of Engineering at the Pontifícia Universidade Católica do Rio Grande do Sul (PUC-RS). In 1998, he spent a sabbatical year in the Service d'Automatique at the University of Mons, Belgium. In 2010, he joined to the Department of Automation and Systems of the Universidade Federal de Santa Catarina, where he is currently a senior lecturer. His research interests include robust control and filtering, stability analysis and control of nonlinear systems, stability analysis and control of uncertain 2-D discrete-time systems, time-delay systems, quantized systems, switched systems, with applications in robotics, bioprocess control, power electronics and power systems.