Robust control

Component
École Nationale Supérieure d'Électrotechnique d'Électronique

In brief

- **Ametys Code:** N9EE17A
- **Open to exchange students:** Yes

Presentation

Objectives

Present the methods allowing to take into account model uncertainties in the context of state-space models for linear time-invariant systems. Describe the numerical and mathematical tools based on convex optimisation and Lyapunov stability theory leading to Linear Matrix Inequalities (LMI) whose feasibility can be checked using very efficient numerical tools.

Description

Chapter 1 - Introduction

Discuss historical issues and the limitations of classical control design methods when significative model uncertainties are present.

Chapter 2 - Complements about linear-time-invariant systems

Summarize the main concepts used in robust control to formulate the control design problem through an optimization problem, if possible, convex. In particular, signal and system norms (H2 and Hinfinity norms), controllability and observability gramian, and associated computation methods, are presented.

Chapter 3 – Linear Matrix Inequalities

Introduce the concept of linear matrix inequality, give the first examples in the context of Lyapunov theory for linear-time-invariant systems (Lyapunov equation). Present and use some mathematical tools like Schur-complement or S-procedure to transform a control design problem in a way leading to LMI optimization problem.

Chapter 4 – Some control design techniques using LMIs

Using the results developed in the previous chapters, present the robust control designs techniques for uncertain linear time invariant systems described by state-space models. In particular, perturbation rejection and pole placement problems are detailed. The chapter focuses essentially on state-feedback but the case of output feedback is evoked.

Pre-requisites

Course on Modelling, analysis and control of linear systems : input-output model, state-space model

Course on Control of single input - single output systems

Course on Control of multi inputs – multi outputs systems

Basic course in mathematics