EL2700 Model Predictive Control 7.5 credits

Modell-prediktiv reglering

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for EL2700 valid from Autumn 2016

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Automatic Control, Basic Course, or permission by the coordinator.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After the course, you should be able to

- analyze properties of discrete-time linear systems in state-space form
- compute optimal open-loop controls for state transfer using linear and quadratic programming
- use dynamic programming to design state estimators and linear controllers that minimize a quadratic cost criterion in the states and controls (LQG-optimal controllers)
- understand the receding-horizon idea and how MPC extends LQG-optimal control to deal with state and control constraints
- design MPC controllers for engeinering systems, making effective use of its tuning parameters to meet closed-loop performance targets
- have a basic understanding of stability properties of MPC controllers
- know how MPC can be implemented as either an nonlinear control law or using on-line optimization

Course contents

Properties of discrete-time linear systems in state-space form; optimal state transfer by linear and quadratic programming; design of linear-quadratic optimal controllers using dynamic programming; model predictive control and the receding horizon principle; dealing with state and control constraints; design and tuning of model predictive controllers and receding-horizon estimators; output feedback MPC; reference-following MPC; stability analysis of MPC controllers; implementation as explicit nonlinear feedback law or by real-time optimization

Disposition

Lectures, Exercises, Computer exercises, Laboratory works. Homeworks

Course literature

J. B. Rawlings and D. Q. Mayne, Model Predictive Control: Theory and Practice, Nob Hill Publishing, 2015.

Examination

- LAB1 - Lab 1, 1.5 credits, grading scale: P, F
- LAB2 - Lab 2, 1.5 credits, grading scale: P, F
- LAB3 - Lab 3, 1.5 credits, grading scale: P, F
- TEN1 - Exam, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

LAB1 1.5p

LAB2 1.5p

LAB3 1.5p

TEN1 3p

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.