



PREDICTIVE CONTROL FRTN15 2011

Welcome to the course *FRTN15 Predictive Control* given by the Department of Automatic Control, Lund University (WWW-address <http://www.control.lth.se>).

Personnel

The lectures are given by Rolf Johansson (Rolf.Johansson@control.lth.se, tel. 046-222 8791, office M:5145; Office hour M16.00-17.00) and Anders Widd (tel. 046-222 0362, Anders.Widd@control.lth.se, Office hour M 8-10, M:2208). Problem solving sessions and labs are given by Marzia Cescon (tel. 046-222 8784, Marzia.Cescon@control.lth.se, Office hour W 13-14, M:2158); Meike Stemmman (tel. 046-222 9745, Meike.Stemmman@control.lth.se, Office hour W 13-14, M:2156). News are available on www.control.lth.se/course/FRTN15.

Prerequisites

Automatic Control (FRT 010) & Some background in discrete-time signals and systems.

Course Material

- Lecture notes: *Predictive and Adaptive Control* (R. Johansson), KFS, Lund, 2011.;
- Additional reading: K. J. Åström and B. Wittenmark *Adaptive Control* (2nd ed.), Addison Wesley 1995;
- Lab manuals and solutions are available on the web site www.control.lth.se.

Lectures

Lectures will be held in M:E on Tuesdays 13.15–15.00 and Thursdays 8.15–10.00; Wednesdays, 13.15–15.00 and Monday, Sep 26, in Sem. Room M2498 according to the schedule:

W.	Date	N°	Contents
35	30/8	L1	Introduction. Signals & Systems. Real-time Parameter Estimation.
	31/8	L2	Automatic Tuning, Gain Scheduling, Auto-calibration.
36	6/9	L3	ARMAX models. Pole Assignment. Model matching. Optimal Control.
	7/9	L4	Pole Assignment. Model Matching. Disturbance Models.
	8/9	L5	Optimal Prediction. Optimal Predictive Control. The Kalman filter.
37	13/9	L6	Adaptive Control./AW
38	22/9	L7	Adaptive Control.
	23/9	L8	Model Predictive Control
39	26/9	L9	Iterative Learning Control (ILC). Iterative Feedback Tuning (IFT).
	27/9	L10	Model Predictive Control. /AW
40	4/10	L11	Stability: Lyapunov theory
	5/10	L12	Input-Output Stability. Passivity.
	6/10	L13	Stochastic Adaptive Control.
41	13/10	L14	Implementation. Applications.

Problem Solving Sessions

Problem solving sessions are given on F10-12 in E:1124 and on Tu 20/9 in M:E.

	W.	Date	N ^o	Contents
--	----	------	----------------	----------

36	8-9/9	E 1	Simulation of adaptive systems./Meike Stemmann
----	-------	-----	--

Notice simulation sessions in Lab B on Sep 8-9. SIGN UP!

36	9/9	E 2	Real-Time Parameter Estimation.
37	16/9	E 3	Optimal Prediction. Optimal estimation. Kalman filter.
38	20/9	E 4	Adaptive Control
39	30/9	E 5	Model Predictive Control
40	7/10	E 6	Iterative Learning Control (ILC).
41	14/10	E 7	Stability. Robustness.

Interaction

Use office hours, hand-ins, tutorials and lectures for interaction with the instructors.

Computer Simulations

Computer simulation is an excellent way to explore predictive systems for development of insight and ideas for analysis. Simulation is also required for the problems you have to hand in and for several projects. An introduction to computer simulation is given in Exercise #1. Make sure that you have an account on the EFD workstations.

Labs

Lab 1 and Lab2 are held in Lab B in the ME building (M-huset). Lists for signing up are available on the FRTN15 home page.

Lab	Time	Contents	Responsible	Phone	Place
Lab AR1	w.38	Autotuning	Meike Stemmann	222 9745	M:2156
Lab AR2	w.39	Adaptive Control	Marzia Cescon	222 8784	M:2158
Lab AR3	w.41	Predictive Control	Meike Stemmann	222 9745	M:2156

Hand-ins and Project

There will be three home-work problems that you have to solve and handi in during weeks 36, 38 and 39.

HW	Time	Contents	Responsible	Phone	Place
HW1	w.36	Signals and Systems	Marzia Cescon	222 8784	M:2158
HW2	w.38	Adaptive Control	Marzia Cescon	222 8784	M:2158
HW3	w.39	Model Predictive Control	Meike Stemmann	222 9745	M:2156

The projects will be done individually or in small groups. A list of projects will be handed out. You should sign up for a project no later than Friday, October 7. The project should be presented on Friday, December 2, at 10-12.

Examination

The examination will be of a problem solving type. It is to be held on Monday, October 17, 8.00–13.00 in lecture halls M:L1, M:L2. You may use the text-book at the examination.