FRTN15 PREDICTIVE CONTROL 2015

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:5147; Office hour M16.00-17.00). Problem solving sessions and labs are given by Anders Mannesson (tel. 046-222 8792, Anders.Mannesson@control.lth.se, Office hour Th 13-14, M:2211; Jonas Dürango (tel. 046-222 8760, Jonas.Durango@control.lth.se, Office hour W 13-14, M:2170E) Jacob Antonsson (tel. 046-222 4287, Jacoba@control.lth.se, Office hour W 13-14, M:2160A). 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, 2015.;

– 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 Wednesdays 13.15–15.00 and Thursdays 8.15–10.00; Monday, Jan 26, and Monday, Feb 2, at 15.15–17.00 in Sem. Room of Dept. Automatic Control (M:2112B) according to the schedule:

W.	Date	N^o	Contents
4	21/1	L1	Introduction. Signals & Systems. Real-time Parameter Estimation.
	22/1	L2	Automatic Tuning, Gain Scheduling, Auto-calibration.
5	26/1	L3	ARMAX models. Pole Assignment. Model matching. Optimal Control.
	28/1	L4	Pole Assignment. Model Matching. Disturbance Models.
	29/1	L5	Optimal Prediction. Optimal Predictive Control. The Kalman filter.
6	2/2	L6	Adaptive Control.
	4/2	L7	Adaptive Control.
	5/2	L8	Model Predictive Control
7	11/2	L9	Iterative Learning Control (ILC). Iterative Feedback Tuning (IFT).
	12/2	L10	Model Predictive Control.
9	25/2	L11	Stability: Lyapunov theory
	26/2	L12	Input-Output Stability. Passivity.
10	4/3	L13	Stochastic Adaptive Control.
	5/3	L14	Implementation. Applications.

Problem Solving Sessions

Problem solving sessions are given on F13-15 in M:X1a-b.

W.	Date	N^o	Contents
4	23/1	E 1	Simulation of adaptive systems./Meike Stemmann
			Notice simulation sessions in Lab B on Jan 23. SIGN UP!
5	30/1	E 2	Real-Time Parameter Estimation.
6	6/2	E 3	Optimal Prediction. Optimal estimation. Kalman filter.
7	13/2	E 4	Adaptive Control
8	20/2	E 5	Model Predictive Control
9	27/2	E 6	Iterative Learning Control (ILC).
10	6/3	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.

Labs

Lab 1-3 are to be held in Lab B in the ME building (M-huset). Sign up on the FRTN15 home page no later than one day before the first session.

Lab	Time	Contents	Responsible	Phone	Place
Lab PR1	w.5	Autotuning	Jonas Dürango	222 8760	M:2170E
Lab PR2	w.7	Adaptive Control	Jacob Antonsson	222 4287	M:2160A
Lab PR3	w.9	Predictive Control	Jonas Dürango	222 8760	M:2170E

Hand-ins and Project

There will be three home-work problems that you have to solve and hand in during weeks 5, 6 and 8.

HW	Time	Contents	Responsible	Phone	Place
HW1	w.5	Signals and Systems	Jonas Dürango	222 8760	M:2170E
HW2	w.6	Adaptive Control	Anders Mannesson	222 8792	M:2211
HW3	w.8	Model Predictive Control	Jonas & Anders		

The projects will be done in small groups or individually. A list of projects will be handed out. You should sign up for a project no later than Friday, February 27. The project should be presented on Wednesday, April 29, at 10-12.

Examination

The examination will be of a problem solving type. It is to be held on Wednesday, March 18, 14.00–19.00 in Sparta:C. You may use the text-book at the examination.