



FRTN15 PREDICTIVE CONTROL 2016

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 Fredrik Bagge Carlson (tel. 046-222 0847, FredrikB@control.lth.se, Office hour Th 13-14, M:2112A). Jonas Dürango (tel. 046-222 8760, Jonas.Durango@control.lth.se, Office hour W 13-14, M:2170E), Gabriel Ingesson (tel. 046-222 0847, Gabriel@control.lth.se, Office hour W 13-14, M:2112A), Fredrik Magnusson (FredrikM@control.lth.se, tel. 046-222 4287, Office hour W 13-14, M:2160A), and Kristian Soltesz (tel. 046-222 8789, Kristian@control.lth.se, Office hour W 13-14, M:2170A) will participate in laboratory sessions or project supervision. 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;
- Lab manuals and solutions are available on the web site www.control.lth.se.

Lectures

Lectures will be held in M:E on Tuesdays 10.15–12.00 and Thursdays 15.15–17.00; Wednesdays Jan 20, Feb 2 and Feb 24, at 13.15–15.00 in the seminar room of Dept. Automatic Control (M:2112B) according to the schedule:

W.	Date	Nº	Contents
3	19/1	L1	Introduction. Signals & Systems. Real-time Parameter Estimation.
	20/1	L2	Automatic Tuning, Gain Scheduling, Auto-calibration.
	21/1	L3	ARMAX models. Pole Assignment. Model matching. Optimal Control.
4	26/1	L4	Pole Assignment. Model Matching. Disturbance Models.
	28/1	L5	Optimal Prediction. Optimal Predictive Control. The Kalman filter.
5	2/2	L6	Adaptive Control.
	3/2	L7	Adaptive Control.
	4/2	L8	Model Predictive Control
6	9/2	L9	Iterative Learning Control (ILC). Iterative Feedback Tuning (IFT).
	11/2	L10	Model Predictive Control.
8	23/2	L11	Stability: Lyapunov theory
	24/2	L12	Input-Output Stability. Passivity.
	25/2	L13	Stochastic Adaptive Control.
9	1/3	L14	Implementation. Applications.

Problem Solving Sessions

Problem solving sessions are given on F10-12 in E:1147.

W.	Date	N ^o	Contents
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3	22/1	E 1	Simulation of adaptive systems.
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Notice simulation sessions in Lab B on Jan 22. SIGN UP!

4	29/1	E 2	Real-Time Parameter Estimation.
5	5/2	E 3	Optimal Prediction. Optimal estimation. Kalman filter.
6	12/2	E 4	Adaptive Control
7	19/2	E 5	Model Predictive Control
8	26/2	E 6	Iterative Learning Control (ILC).
9	4/3	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	Kristian Soltesz	222 8789	M: 2170A
Lab PR2	w.7	Adaptive Control	Fredrik Bagge Carlson	222 0847	M:2112A
Lab PR3	w.8	Predictive Control	Fredrik Magnusson	222 4287	M:2160A

Hand-ins and Project

There will be three home-work problems that you have to solve and hand in during weeks 5, 6 and 7.

HW	Time	Contents	Responsible	Phone	Place
HW1	w.5	Signals and Systems	Kristian Soltesz	222 8789	M:2170A
HW2	w.6	Adaptive Control	Fredrik Bagge Carlson	222 0847	M:2112A
HW3	w.7	Model Predictive Control	Fredrik Magnusson	222 4287	M:2160A

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 26. The project should be presented on Friday, April 29, at 10-12.

Examination

The examination will be of a problem solving type. It is to be held on Wednesday, March 18, 8.00–13.00 in Sparta:C. You may use the textbook at the examination.