



FRTN15 PREDICTIVE CONTROL 2017

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 Gabriel Ingesson (tel. 046-222 8793, Gabriel@control.lth.se, Office hour W 13-14, M:2209), Pontus Giselsson (tel. 046-222 9744, PontusG@control.lth.se, Office hour Tu 11-12, M:2170B) and Gustav Nilsson (Gustav.Nilsson@control.lth.se, tel. 046-222 1570, M:2427-28) 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, Thursdays 13.15–15.00, and Wednesdays Jan 18, Jan 25, at 13.15–15.00 in the seminar room of Dept. Automatic Control (M:2112B) according to the schedule:

W.	Date	Nº	Contents
3	17/1	L1	Introduction. Signals & Systems. Real-time Parameter Estimation.
	18/1	L2	Automatic Tuning, Gain Scheduling, Auto-calibration.
	19/1	L3	ARMAX models. Pole Assignment. Model matching. Optimal Control.
4	24/1	L4	Pole Assignment. Model Matching. Disturbance Models.
	25/1	L5	Optimal Prediction. Optimal Predictive Control. The Kalman filter.
	26/1	L6	Adaptive Control.
5	31/1	L7	Adaptive Control.
	2/2	L8	Model Predictive Control
6	7/2	L9	Iterative Learning Control (ILC). Iterative Feedback Tuning (IFT).
	9/2	L10	Model Predictive Control.
7	14/2	L11	Stability: Lyapunov theory
	16/2	L12	Input-Output Stability. Passivity.
9	28/2	L13	Stochastic Adaptive Control.
	2/3	L14	Implementation. Applications.

Problem Solving Sessions

Problem solving sessions are given on F10-12 in M:X2b.

	W.	Date	N ^o	Contents
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3	20/1	E 1	Simulation of adaptive systems.
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Notice simulation sessions in Lab B on Jan 20. SIGN UP!

4	27/1	E 2	Real-Time Parameter Estimation.
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5	3/2	E 3	Optimal Prediction. Optimal estimation. Kalman filter.
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6	10/2	E 4	Adaptive Control
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7	17/2	E 5	Model Predictive Control
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8	24/2	E 6	Iterative Learning Control (ILC).
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9	3/3	E 7	Stability. Robustness.
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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 M 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	Gustav Nilsson	222 1570	M:2427
Lab PR2	w.7	Adaptive Control	Gabriel Ingesson	222 8793	M:2209
Lab PR3	w.8	Predictive Control	Gabriel Ingesson	222 8793	M:2209

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	Ingesson/Giselsson	222 8793	M:2209
HW2	w.6	Adaptive Control	Ingesson/Giselsson	222 8793	M:2209
HW3	w.7	Model Predictive Control	Ingesson/Giselsson	222 8793	M:2209

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 24. The project should be presented on Friday, April 28, at 10-12.

Examination

The examination will be of a problem solving type. It is to be held on Tuesday, March 14, 8.00–13.00 in M:L1, M:L2. You may use the textbook at the examination.