



## FRTF01 Physiological Models and Computation

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

### Personnel & Instructors

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 Carolina Lidström (tel. 046-222 1570, Carolina.Lidstrom@control.lth.se, Office hour W 13-14, M:2427b) Fredrik Ståhl (tel. 046-222 8797, Fredrik.Stahl@control.lth.se, Office hour W 13-14, M:2210). News are available on [www.control.lth.se/course/FRTF01](http://www.control.lth.se/course/FRTF01).

### Prerequisites

FMAA01 Calculus, FMA420 Linear Algebra, TEK015 Physiology, ETI265 Signal Processing

### Course Material

- C. Cobelli & E. Carson, *Introduction to Modeling in Physiology and Medicine*, Academic Press, Amsterdam, 2008;
- Visit web site [www.control.lth.se](http://www.control.lth.se) to download home-work assignments, exercises and solutions.

### Lectures

Lectures will be held in M:E on Tuesdays 10.15–12.00 and Thursdays 10.15–12.00, and on Friday, Nov 7, in M:2112B according to the schedule:

W.	Date	N°	Contents
45	4/11	L1	Introduction. Physiological Complexity.
	6/11	L2	Modeling in Physiology.
	7/11	L3	Control in Physiological Systems.
47	18/11	L4	Physiological Feedback, Adaptation, Learning (Pupil Dynamics).
	20/11	L5	Pharmacokinetics & Tracers.
48	25/11	L6	Metabolism, Glucose & Insulin Dynamics.
	27/11	L7	Biomechanics: Muscle Models, Postural Control, Gait.
49	2/12	L8	Electrophysiology. The Hodgkin-Huxley Model.
	4/12	L9	Blood Flow Control, Temperature Control, Concentration & pH Control.
50	9/12	L10	System Identification. Measurements & Data-based modeling.
51	16/12		(Repetition)
	18/12		(Project Presentations.)

## Problem Solving Sessions

Problem solving sessions are given on alternating days each week in INA3-4 except on Monday, Dec 1, 8-10 in Em 1-3

W.	Date	N <sup>o</sup>	Contents
45	7/11	E0	Introduction to Matlab & Simulink.
46	11/11	E1	Biochemical Reactions.
	14/11	E2	Modeling in Physiology.
47	17/11	E3	Control in Physiological Systems I.
	21/11	E4	Control in Physiological Systems II.
48	27/11	E5	Pharmacokinetics & Tracer Dynamics.
	28/11	E6	Glucose & Insulin Dynamics.
49	1/12	E7	Biomechanics.
	5/12	E8	Electrophysiology & The Hodgkin-Huxley Model
50	11/12	E9	Blood Flow Control; Temperature, Concentration & pH Control
	12/12	E10	System Identification.
51	19/12	Extra	Repetition.

## Interaction

Use office hours, home-work assignments, tutorials and lectures for interaction with the instructors.

## Computer Simulations

Computer simulation is an excellent way to explore physiological 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 #0.

## Home-Work Assignments

There will be four home-work problems that you have to solve and hand in during course weeks 3, 4, 5, 6 (calender weeks 47, 48, 49 and 50) with deadlines.

HW	Time	Contents	Responsible	Phone	Place
HW1	w.47—21/11	Enzyme Dynamics	F. Ståhl	222 8797	M:2427
HW2	w.48—28/11	Pupil Dynamics	C. Lidström	222 1570	M:2210
HW3	w.49—5/12	Glucose & Insulin Dynamics	F. Ståhl	222 8797	M:2427
HW4	w.50—12/12	The Hodgkin-Huxley Model	C. Lidström	222 1570	M:2210

Send your solution to <FRTF01@control.lth.se>.

## FRTF01 Project

The projects will be done in small groups or individually. You should sign up for a project no later than Monday, November 24. The project should be presented on Thursday, December 18, at 10-12 in M:E. Submission of report on December 11.

## Examination

The examination will be of a problem solving type. It is to be held on Monday, January 12, 8.00–13.00 in lecture halls MA:MA10-E-F. You may use the text book at the examination.