Systems and Control
Department of Information Technology
UPPSALA UNIVERSITY
www.it.uu.se/research/syscon

INTRODUCTION TO COMPUTER-CONTROLLED SYSTEMS: SYLLABUS

Master program in embedded systems, period 2, 2010

Instructors

Name:	Building	Office:	Tel:	Course part:
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Textbook

T. Glad and L.Ljung "Control theory: Multivariable and Nonlinear Methods", Taylor & Francis, London and New York. *2000*.

Additional material

- Manuals for computer and process labs, available in electronic form on the home page of the course.

Regarding the textbook

The textbook covers the material for two courses in control engineering, namely the present one and a continuation course Automatic Control II.

The textbook is available at the bookstores *Studentbokhandeln* and *Akademibokhandeln* (LundeQ). It can also be ordered on the web, for instance at `bokus.se` and delivered in 5-8 working days.

- Chap. 1
  - 1.3 – Discrete and continuous time models and controllers
  - 1.4 – Some basic concepts in control
  - 1.6 – Stability of solutions
- Chap. 2

  - 2.1 Impulse response
  - 2.2 – Transfer function matrices
  - 2.3 – Transfer operator
  - 2.4 – Input-output equations
  - 2.5 – State-space form
  - 2.6 – Discrete time systems
- Chap. 3
  - 3.1 – Solving the system equations
  - 3.2 – Controllability and observability (not PBH Test)
  - 3.3 – Poles and zeros (only SISO case)
  - 3.4 – Stability
  - 3.5 – Frequency response (only SISO case)
  - 3.7 – Discrete time systems
- Chap. 4
  - 4.1 – Approximating continuous time systems
  - 4.2 – System sampling
- Chap. 5
  - 5.1 – Disturbances
  - 5.7 – Observers and Kalman filters (only observers)
  - 5.8 – Discrete time systems (only observers)
  - 5.9 – Practical aspects of signal sampling
- Chap. 6
  - 6.1 – The transfer functions of the closed loop system (only SISO)
  - 6.3 – Sensitivity and robustness
  - 6.5 – Specifications in time domain
  - 6.7 – Sampled data controllers
- Chap. 8.
  - 8.1 – Main ideas
  - 8.3 – Internal model control (not all stabilizing controllers)
  - 8.4 – Feedback from reconstructed states
- Chap. 15
  - 15.2 Nonlinear internal model control (integrator windup)

Laboratory assignments
There are two types of lab exercises in this course: simulation assignments and process assignments. All of them are mandatory.

Process assignments, (3×4 hours, in 2 groups), are to be carried out at P4404, house 4, Polacksbacken.
The process assignments are based on large chunks of the course material and make use of `LEGO NXT`. It is important to prepare for the process assignments by reading correspondent chapters of the course book, lecture notes and lab manuals.

Simulation assignments will help you to check your theoretical knowledge before you apply it to LEGO robots in practice. Laboratory reports are written during the lab hours and have to be checked by the lab instructors by the end of the day.

Lab nr.	Topic
1	Actuate, measure and close the loop
2	Modeling, analysis and PID-control
3	Model-based control design

Sign-up lists for process labs will be placed on the door of P4404. It is possible to switch between the lab groups but you have to negotiate it on your own with somebody from the other group.

Examination
The following is required to pass the course:

- all the lab assignments have to be performed and the lab reports be approved by the lab instructors
- a satisfactory grade obtained at the written exam.

For the written exam you are allowed to have with you: a copy of the textbook, copies of the lecture notes and slides from the course, your own hand-written notes made during the lectures and problem solving sessions, a mathematical handbook, a calculator.

Preliminary course plan
The course includes 10 lectures (L), 10 problem solving sessions (Ex), two simulation assignments (CL) and three process assignments (PL).

Week		Contents
43	L1	
	L2	
44	Ex1	
	PL1	Process assignment 1, Group A
	PL1	Process assignment 1, Group B
45	L3	
	L4	
	L5	
	L6	
	Ex2	
46	Ex3	
	Ex4	
	CL1	Simulation assignment 1
	PL2	Process assignment 2, Group A
	PL2	Process assignment 2, Group B
47	L7	
	L8	
	L9	
	Ex5	
48	Ex6	
	Ex7	
	Ex8	
	CL2	Simulation assignment 2
49	L10	
	Ex9	
	PL3	Process assignment 3, Group A
	PL3	Process assignment 3, Group B
50	Ex10	Typical exam problems
	Written exam	**Fre 17/12**