



Course syllabus

Faculty Board of Science and Engineering
School of Computer Science, Physics and Mathematics

4ED114 Reglerteknik fortsättningskurs, 7,5 högskolepoäng
Automatic Control Advanced Course, 7.5 credits

Main field of study
Electrical Engineering

Subject Group
Electrical Engineering

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved by Organisational Committee 2009-12-01

The course syllabus is valid from autumn semester 2010

Prerequisites
Automatic Control 7.5 higher education credits (2ED013) or the equivalent.

Expected learning outcomes

Upon completion of the course the student should be able to:

- analyse a linear system with the use of state space models in continuous, as well as in discrete time
- to design controllers for linear systems based on state space models when poles are given or when a given quadratic loss function is to be minimized
- analyse non linear systems, including controlled non linear systems, with respect to stability with the help of some standard methods
- Be able to analyse simple, non linear systems with phase plane analysis.

Content

Part 1 Analysis and synthesis based on state space models

- State space models of linear systems.
- State feedback control and feedback from reconstructed states. Controllability and observability and their relations to state feedback control and feedback from reconstructed states.
- Sampling of linear systems
- Optimal control of linear system, especially the method based on minimization of a quadratic criterion is treated.

Part 2 Analysis of non linear control systems

- A number of stability concepts. Linearization of a non linear system. Phase plane analysis.
- Prediction of the amplitude and frequency of stable periodic solutions using the describing function method.
- Using Lyapunov functions to prove stability of a system. Lyapunov's linearization method.
- Introduction to the theory of input-output stability, the circle criterion.

Part 3 Laboratory work

- Control of a physical process. State estimation based on data from a physical process.
- Simulation of dynamical systems using programs as Matlab, Simulink, Dymola or 20-sim.

Type of Instruction

Teaching consists of lectures, seminars and practical work. Attendance at some activities may be mandatory.

Examination

The course is assessed with the grades U,3,4 or 5.

A translation of the grade to the ECTS scale may be obtained upon request. The request for a translation should be made before the grade for the course is awarded.

Assessment of the student's performance is made through written examination and/or orally and/or presentation of mandatory assignments. The assessment method is decided at the start of the course. Students who do not pass the regular examination are given the opportunity to do a resit examination shortly after the regular examination.

Course Evaluation

A written course evaluation will be carried out at the end of the course in accordance with the guidelines of the University. The course evaluation will be filed at the department.

Other

Upon request, a Swedish University course certificate will be awarded upon successful completion of the course.

Students who receive a passing grade in the course may download a course certificate through the Student Portal. Otherwise they may request a course certificate from the school secretary.

Required Reading and Additional Study Material

Required reading

Torkel Glad, Lennart Ljung, *Control theory, Multivariable and Nonlinear Methods*, Taylor and Francis, 2000. Pages 250 (467)

Gene F. Franklin, J. David Powell, Abbas Emami-Naeini, *Feedback Control of Dynamic Systems*, Prentice Hall. Pages 300 (928).