Course syllabus

Faculty of Technology

Department of Physics and Electrical Engineering

4ED435 Reglerteknik för energisystem, 7,5 högskolepoäng
Automatic Control for Energy Systems, 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 Faculty of Technology 2018-12-10
The course syllabus is valid from autumn semester 2019

Prerequisites
Basic eligibility for advanced level studies and special eligibility:

- Bachelor's degree or Bachelor of Science degree in Electrical Engineering or Energy technology or Mechanical Engineering or equivalent, 180 credits
- Signals and Systems or equivalent, 7.5 credits
- Electrical and Control Engineering or equivalent, 7.5 credits
- English B/ English 6 or equivalent

Objectives

After completing the course the student should:

- be able to describe dynamic systems by means of mathematical models
- be able to perform a stability analysis for both open systems and closed control system
- be able to understand and indicate specifications for a control system in both the time domain and frequency domain
- be able to make reasonable estimates of a transient response and the steadystate response based on the poleplacement of the closed system and on the Bode diagram for the open system
- be able to analyze multi-input - multi-output control systems based on a state-space description of the system
- master the design methods: poleplacement, leadlag compensation, feedforward and cascade compensation
- based on a block diagram be able to simulate the behavior of the system in the time domain.

- be able to apply the theory to energy systems

Content

All treated dynamical systems are time continuous and time invariant. With a few exceptions, they are all linear.

- Introduction to automatic control: history, examples of control system and basic concepts of automatic control.
- Modeling of dynamical system using time invariant ordinary differential equations. Linearization, statespace model, weighting function, Laplace transform, transfer function, Nyquist and Bode diagram.
- Analysis of dynamic system. Concepts of stability. Analysis of stability using Root locus, RouthHurwitz criterion, the principle of the argument and the Nyquist criterion. Gain margin and phase margin.
- Synthesis of control systems. Specifications, poleplacement, leadlag compensation, PIDcontroller, feed forward, cascade compensation, robustness, sensitivity for disturbances and changes in parameters.
- State-space description. Multi-input – multi output control systems. Feedback, internal and external stability.
- The electric power grid as application.

Type of Instruction

Teaching consists of lectures, laboratory sessions and self-study. Attendance at laboratory sessions is mandatory.

Examination

The course is assessed with the grades A, B, C, D, E, Fx or F.
The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student's performance is assessed as fail (i.e. received the grade F).

Assessment of the student's performance is made through written examination and assignments, of which at least one is a written assignment.
The final grade is a weighted average of assessment methods.

Course Evaluation

During the course or in close connection to the course, a course evaluation is to be carried out. The result and analysis of the course evaluation are to be communicated to the students who have taken the course and to the students who are to participate in the course the next time it is offered. The course evaluation is carried out anonymously. The compiled report will be filed.

Credit Overlap

The course cannot be included in a degree along with the following courses of which the content fully, or partly, corresponds to the content of this course: 2ED013 Automatic control, 7.5 credits; or: 2ED313 Automatic control, 7.5 credits

Other

Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

Some course elements may entail costs defrayed by the course participant.

Required Reading and Additional Study Material

Gene F. Franklin, J. David Powell, Abbas Emami-Naeini, Feedback Control of Dynamic Systems, 8th edition. Pearson, 2018. Pages 500 (928).

Handouts, 50 pages