Automatic Control

Programme course

6 credits

Reglerteknik

TSRT22

Valid from: 2017 Autumn semester

Determined by
Board of Studies for Industrial Engineering and Logistics

Date determined
2017-01-25

Main field of study
Electrical Engineering

Course level
First cycle

Advancement level
G2X

Course offered for
- Industrial Engineering and Management, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Energy-Environment-Management M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Calculus, one variable, Calculus, several variables, Linear Algebra

Intended learning outcomes

After completing this course students should be able to describe the basic requirements for and limitations of automatic control. Students should also be able to perform analysis and systematic construction of feedback control systems. This means that students will be expected to be able to do the following after completing this course:

- Define basic concepts in the area of automatic control.
- Transform mathematical models of linear dynamic systems between time domain input/output form, transfer function form, and state space form.
- Analyse models of linear dynamic systems that are given in the forms above with respect to stability, pole placement, rise time, damping, controllability and observability.
- Demonstrate the connections between the system properties of stability, rise time and damping in time and frequency domains.
- Derive input/output signal relationships in feedback control systems using block diagram calculations.
- Perform stability analysis of feedback control systems using Bode diagrams.
- Construct regulators in PID-form, lead-lag form, state space form, and feedforward form based on given specifications.
- Perform stability and robustness analysis of feedback control systems using the root locus method and robustness criteria respectively.
- Exemplify the significance of automatic control on efficient management of environmental impact as well as energy and resource use in various technical systems.

Course content

Dynamical systems. The feed-back principle. Differential equations, transfer functions, stability, error constants. PID control, relationships between dynamical properties and pole location. Root locus. Frequency response, Bode diagram. Stability analysis using Bode diagrams, phase and ampitude margin. Specifications in the frequency domain, lead-lag compensation, sensitivity and robustness. State space models. State feedback, observers.

Teaching and working methods

The course consists of lectures, lessons and laboratory work.

Examination

LAB1	Laboratory work	1.5 credits	U, G
TEN1	Written examination	4.5 credits	U, 3, 4, 5

Grades
Four-grade scale, LiU, U, 3, 4, 5

Other information
Supplementary courses:
Industrial control systems, Modeling and simulation, Control theory

Department
Institutionen för systemteknik

Director of Studies or equivalent
Johan Löfberg

Examiner
Svante Gunnarsson

Course website and other links
http://www.control.isy.liu.se/student/kurser

Education components
Preliminary scheduled hours: 64 h
Recommended self-study hours: 96 h

Course literature
Glad T., Ljung L.: Reglerteknik. Grundläggande teori. Studentlitteratur.
Övningsexempel.