Automatic Control

Programme course

6 credits

Reglerteknik

TNG028

Valid from: 2018 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Electrical Engineering

Course level
First cycle

Advancement level
G2X

Course offered for
- Electronics Design Engineering, M Sc in Engineering
- Communication and Transportation Engineering, M Sc in Engineering
- Media Technology and Engineering, 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
Signals and systems, Transform theory

Intended learning outcomes

The course shall give understanding of dynamic systems and knowledge about the basic methods to analyse and design feedback control system. After completing the course the student should be able to

- understand and apply basic concepts in the area of automatic control
- transform mathematical models of dynamic linear systems between input-output form , transfer function form and state space form.
- formulate system performance in terms of rise time, oscillations, steady-state values, controllability and observability
- demonstrate how the system performance can be determined by the poles of the transfer function
- perform block diagram calculation in order to express qualitatively the effect of design parameters on the performance of the control system
- understand how frequency domain methods as Bode diagram and Nyquist diagram, can be used to design controller in terms of lead-lag filters in order to obtain desired system performance
- perform stability analysis of feedback control systems using methods such as root locus, Nyquist diagram and bode diagram
- understand and use the concept of state
- understand the basic properties of the observer and how it can be used in dimensioning feedback systems with state feedback
- understand how a high-level language as MATLAB is used for analysis and design of feedback systems
- understand how to implement control systems with the help of high-level programming (Simulink) in a laboratory environment
- be theoretically prepared to continue studies and to work in areas related to automatic control

Course content

Introduction: Dynamic systems. The feedback principle.
Mathematical models I: Differential equations, transfer functions, stability, error constants.
Design I: PID-control. Relationships between dynamic properties and pole location. Root locus. The Nyquist criterion.
Mathematical models II: Frequency response, Bode diagram, Nyquist diagram, stability analysis in frequency domain, phase and amplitud margin.
Design II: Specifications in the frequency domain, lead-lag compensation, sensitivity and robustness.
Mathematical models III: State space representation. Controllability and observability.
Design III: State feedback. Observers.

Teaching and working methods

The course consists of lectures, tutorials, MATLAB exercises and laboratory sessions.

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: Modeling and simulation

Department

Institutionen för teknik och naturvetenskap

Director of Studies or equivalent

Adriana Serban

Examiner

Anna Lombardi

Course website and other links

http://www2.itn.liu.se/utbildning/kurs/

Education components

Preliminary scheduled hours: 60 h
Recommended self-study hours: 100 h

Course literature

Additional literature

Books

T. Glad och L. Ljung, (2006) *Reglerteknik - Grundläggande teori*
Studentlitteratur

Compendia

Exercises.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.