Control Theory

Programme course

6 credits

Reglerteori

TSRT09

Valid from: 2017 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
Second cycle

Advancement level
A1X

Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Electronics Design Engineering, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, 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
Automatic control, Statistics

Intended learning outcomes

The course gives the basic theory required to solve more difficult control problems. This implies analysis and design of multivariable systems, basic insights in nonlinear phenomena, in particular methods for nonlinear stability analysis as well as tradeoffs and basic limitations for control systems. A course goal is also to give an ability in using computer based control design. When the course is finished the participants are expected to be able to

- Describe possibilities and limitations in multivariable control design and given an account of conflicts between performance requirements.
- Model disturbances, analyze their influence and design control systems to counteract them.
- Calculate stationary points, linearize and perform local analysis of state space systems.
- Perform stability analysis using the circle criterion, describing functions and elementary Lyapunov theory.
- Design multivariable control systems using LQG methods, loop shaping methods and computer based tools (and in very simple cases by hand calculations).
- Design controllers that completely eliminate simple nonlinearities.

Course content

Mathematical description of linear multivariable systems in continuous time. Controllability and observability. Stability. Description of disturbances. Synthesis of regulators. Sensitivity and robustness. Performance limitations.
Linear quadratic theory. Observers. The separation principle
LTR-methodology. Robust loop-shaping. Nonlinear systems: The effect of nonlinearities, phase planes, stability. Lyapunov theory, the circle criterion, describing function. Exact linearization.

Teaching and working methods

The course consists of lectures, lessons and laboratory work.

Examination

LAB1	Laboratory work	1.5 credits	U, G
DAT1	Written examination	4.5 credits	U, 3, 4, 5

Grades

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

Department

Institutionen för systemteknik

Director of Studies or equivalent
Johan Löfberg

Examiner
Daniel Axehill

Course website and other links

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

Course literature
T. Glad, L. Ljung: Reglerteori. Flervariabla och olinjära metoder, Studentlitteratur, Lund, 2003. Övningsuppgifter med lösningar. Laborationshandledningar.

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.