Multivarable and Robust Control Systems 7.5 credits R7005E

Multivariabla och robusta reglersystem

Course syllabus admitted: Spring 2017 Sp 3 - Spring 2017 Sp 4

DECISION DATE
2016-06-15

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Multivariabla och robusta reglersystem

Second cycle, R7005E

Education level	Grade scale	Subject	Subject group (SCB)
Second cycle	G U 3 4 5	Reglerteknik	Automation Technology

Entry requirements

Intermediate level knowledge in the subject of Automatic control, specifically regarding transfer functions, frequency response, state-space form, state feedback, and the Nyquist criterion. Experience with using Matlab for analysis of control systems is also presumed (R7003E).

Selection

The selection is based on 30-285 credits

Examiner

Wolfgang Birk

Course Aim

The course aim is for students to acquire in-depth knowledge of feedback systems, their design and their use in control engineering applications.

The students should be able to:

- show a deep knowledge of control engineering methods and terminology for multivariable and robust control
- show deep understanding of mathematical methods to analyze multivariable dynamic systems and dynamic systems with uncertainty descriptions
- demonstrate the ability to model multivariable dynamic systems based on empirical data and formulate uncertainty descriptions of dynamical systems
- demonstrate an ability to formulate performance requirements for control systems and determine what performance is achievable
- use standard methods for designing and analyzing robust controllers and controllers for multivariable systems
- demonstrate an ability to, in a group , simulate , analyze , evaluate and implement multivariable controllers for a real process and to report on this work, both orally and in writing
- ability to identify constraints of simple controller s and the need for more advanced methods.

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Contents

When attempting to apply control to a complex real-world process, a number of problems appear that this course provides theoretical methods to handle. The first problem treated in the course is that the process model that is available can never be an exact description of the process in question. How to describe model uncertainty is treated, as well as methods for designing robust controllers that maintain stability and performance despite variations in the process. The second problem is that many processes that are interesting to be able to control are in practice multivariable, i.e. that several inputs affect several outputs. Basic notions, such as poles and zeros, controllability and observability are treated for multivariable systems, as well as methods to determine when single variable controllers can be used on the multivariable process with acceptable performance. Controllers, based on optimization in the H-infinity norm, are treated for the situation where multivariable control must be used. The third problem is fundamental limitation regarding the performance that can be achieved in a control system. Such limitations appear in particular when the process is unstable or has nonminimum phase character. Tools to analyze this are also provided in this course. The theoretical parts of the course are supplemented with practical lab work and a project assignment on an experimental setup in the laboratory of the Department of Computer Science and Electrical Engineering.

Realization

Each course occasion´s language and form is stated and appear on the course page on Luleå University of Technology's website.
The teaching consists of lectures and laboratory exercises

Examination

If there is a decision on special educational support, in accordance with the Guideline Student's rights and obligations at Luleå University of Technology, an adapted or alternative form of examination can be provided. Written exam with differentiated grades and approved lab and project work

Remarks

The course will not be given every year.

Overlap

The course R7005E is equal to SMR047

Literature. Valid from Autumn 2008 Sp 1

Skogestad, S. and Postlethwaite, I.: Multivariable Feedback Control. Analysis and Design. Wiley 2005

Course offered by

Department of Computer Science, Electrical and Space Engineering

Items/credits

Number	Type	Credits	Grade
0001	Written exam	4.5	G U 3 4 5
0002	Laboratory work	3	U G#

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Study guidance

Study guidance for the course is to be found in our learning platform Canvas before the course starts. Students applying for single subject courses get more information in the Welcome letter. You will find the learning platform via My LTU.

Last revised

by Jonny Johansson, HUL SRT 2016-06-15

Syllabus established

by Department of Computer Science and Electrical Engineering 2007-12-17

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