LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Reglerteori
Control Theory

FRTF15, 3 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED F/Pi
Date of Decision: 2023-04-18

General Information

Main field: Technology.
Elective for: D4, F3, Pi2
Language of instruction: The course will be given in Swedish

Aim

The aim of the course is to give a deeper knowledge and understanding for the mathematical theory behind many of the concepts and methods taught in the Basic Course in Automatic Control.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- understand the matematical definition of the Laplace transform and frequency response curves
- understand the interpretation of the general solution to the state-space description as a mapping and how this can be used to define controllability and observability

Competences and skills
For a passing grade the student must

- be able to use the argument principle, the Nyquist theorem, and Bode's relations to decide stability and robustness
- master the sensitivity functions and its properties
- be able to use coordinate changes in state-space to show properties of zeros, state feedback, and observers

- be able to use the relationships between different criteria for controllability and observability
- be able to apply Kalman's decomposition formula in order to understand series connections, and cancellations and non observability in state feedback
- be able to present concepts from automatic control on oral and written form

Judgement and approach
For a passing grade the student must

- understand the value of mathematical reasoning as a tool for solving control problems
- be able to grasp a mathematical proof as a part of understanding, e.g., the proof of the Nyquist theorem and Bode's relations
- be able to discuss and present group work in the form of the solution to a hand-in problem

Contents

The course is given in parallel with the Basic Course in Automatic Control. It brings up many of the concepts that are being taught in the basic course from a more mathematical perspective. Some examples are: Solutions to the system equations, deduction of controllability and observability criteria, Kalman's decomposition formula, the argument principle, robustness analysis.

Examination details

Grading scale: UG - (U,G) - (Fail, Pass)
Assessment: One problem-oriented hand-in problem and one mini-project with opposition that is presented in oral and written form.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0117. **Name:** Hand-in Problem.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Passed or not passed.
Code: 0217. **Name:** Special Exercise.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Passed or not passed

Admission

Assumed prior knowledge: FMAF01 Mathematics - Analytic Functions and FMAF05 Mathematics - Systems and Transforms.
The number of participants is limited to: No
The course overlaps following course/s: FRT130

Reading list

- Åström K.J: Reglerteori, Almqvist & Wiksell, 1976 or.
- Åström K J: Introduction to Control, 2004 (book manuscript).
- Handout material.

Contact and other information

Course coordinator: Richard Pates, richard.pates@control.lth.se
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Course homepage: http://www.control.lth.se/course/FRTF15