



LTH

FACULTY OF
ENGINEERING

Course syllabus

Applied Mathematics - Linear systems Tillämpad matematik - Linjära system

FMAF10, 5.0 credits, G2 (First Cycle)

Valid for: 2025/26

Faculty: Faculty of Engineering LTH

Decided by: PLED F/Pi

Date of Decision: 2025-04-10

Effective: 2025-05-05

General Information

Main field: Technology **Depth of study relative to the degree requirements:** First cycle, in-depth level of the course cannot be classified

Mandatory for: C3, D2

Elective for: B4, BME4, K4, L4-gi, M4, R4, W4

Language of instruction: The course will be given in Swedish

Aim

The aim of the course is to treat some mathematical concepts and methods, above the basic level, that are important for further studies within e.g. machine learning, signal processing, control theory, electrical engineering and for further professional activities.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- be able to describe different properties of linear systems, and to explain how they can be modelled in the time domain and in the frequency domain.

- be able to define the Laplace transform and account for its significance in connection with input/output relations and the solution of differential equations, and be able to use simple transform tables to determine transforms/inverse transforms.
- be able to use matrix theory to analyse quadratic forms and to solve systems of linear differential equations.

Competences and skills

For a passing grade the student must

- be able to demonstrate the ability to identify problems that can be modelled with linear systems, and be able to analyse the corresponding models.
- be able to demonstrate the ability to use the introduced concepts in connection with problem solving.
- with proper terminology, suitable notation, and with clear logic be able to explain the solution to a problem in a well structured manner.

Contents

Linear systems: Mathematical models of linear, time invariant systems. Transfer function. Step response and impulse response. The frequency function.

The Laplace transform: Step and impulse functions. Computational rules for the two-sided Laplace transform. Inverse transforms, in particular of rational functions. Use of transform tables. Convolution.

Matrix algebra: Eigenvalues and eigenvectors. Diagonalization, in particular of symmetric matrices. Quadratic forms, diagonalization and classification. Systems of differential equations: solution by diagonalization, solution using exponential matrix.

Examination details

Grading scale: TH - (U, 3, 4, 5) - (Fail, Three, Four, Five)

Assessment: Written test. Computer sessions.

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.

Modules

Code: 0109. **Name:** Applied Mathematics.

Credits: 5.0. **Grading scale:** TH - (U, 3, 4, 5). **Assessment:** Written test comprising theory and problems. **The module includes:** See course contents.

Code: 0209. **Name:** Computer Work.

Credits: 0.0. **Grading scale:** UG - (U, G). **Assessment:** 1. Use of computer algebra systems to perform calculations common in the mathematical analysis of linear systems. 2. With the aid of Matlab programs, the meaning of important concepts within systems theory is illustrated.

Admission

Admission requirements:

- FMAB65 Calculus in One Variable B1 **or** FMAB70 Calculus in One Variable B2

Assumed prior knowledge: Basic university courses in calculus and linear algebra.

The number of participants is limited to: No

Kursen överlappar följande kurser: FMA030 FMA037 FMA062 FMA450 FMAF05

Reading list

- Spanne, S. & Sparr, A: Föreläsningar i Tillämpad matematik - Lineära system. KF-Sigma, 1996.
- Spanne, S. & Sparr, A: Övningar i Tillämpad matematik 2 - Lineära system. KF-Sigma, 1996.

Contact

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