LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Matristeori
Matrix Theory

FMAN71, 7,5 credits, A (Second 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: BME4, C4, D4-bg, D4-ssr, E4-ra, F4, F4-tf, F4-bs, F4-bg, F4-r, F4-mai, I4, Pi3
Language of instruction: The course will be given in English on demand

Aim

The main aim of the course is to convey knowledge about concepts and methods from matrix theory and linear algebra which are important in applications within many subjects in technology, science and economy, and familiarity with their use. In addition, the course should develop the student's ability in general to assimilate and communicate mathematical theory and to solve problems. Furthermore, the course should strengthen the student's ability in mathematical programming.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- independently be able to characterize and use different types of matrix factorizations.
- be able to understand and independently explain the theory of matrix functions, in particular polynomials, and its connection to the Jordan normal form.
- be able to describe different types of vector and matrix norms, and to compute or estimate them as well with as without computer support.
- be able to state the common classes of normal matrices and their properties.
- be able to account for the main results in the theory of non-negative matrices, and be able to describe applications of them.

Competences and skills
For a passing grade the student must

- with access to literature be able to integrate methods and approaches from the different parts of the course in order to solve problems and answer questions within the framework of the course.
- with access to literature be able to write Matlab programs for the solution of mathematical problems within the framework of the course.
- orally and in writing, with clear logic and with proper terminology be able to explain the solution to a mathematical problem within the framework of the course.
- with access to the resources of a library be able to independently assimilate and sum up the contents of a text in technology in which matrix theoretical methods are used.

Contents

Matrices and determinants. Linear spaces. Spectral theory.The Jordan normal form. Matrix factorizations. Matrix polynomials and matrix functions. Norms. Scalar products. Singular values. Normal matrices. Quadratic and Hermitian forms. The Least Squares method and pseudo inverses. Non-negative matrices. Some important inequalities.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Take-home exam followed by an oral exam. Two minor computer projects should be completed before the exam.

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.

Admission

Admission requirements:

- FMA420 Linear Algebra or FMA421 Linear Algebra with Scientific Computation or FMAA20 Linear Algebra with Introduction to Computer Tools or FMAA21 Linear Algebra with Numerical Applications or FMAB20 Linear Algebra

Assumed prior knowledge: FMAF05 Systems and Transforms or FMAF10 Applied Mathematics - Linear systems.
The number of participants is limited to: No
The course overlaps following course/s: FMAN70, FMA120, FMA121, MATC70

Reading list

- Holst, A & Ufnarovski, V: Matrix Theory. Studentlitteratur, 2014, ISBN: 978-91-44-10096-8.

Contact and other information

Course coordinator: Studierektor Anders Holst, Studierektor@math.lth.se
Teacher: Carl Olsson, Carl.Olsson@math.lth.se

Course homepage: https://canvas.education.lu.se/courses/20383