

Applied Linear Algebra

ECTS

5

Prerequisites

Upper-level mathematics equivalent to A-levels.

Main purpose

The purpose of the course is to equip the student with basic knowledge about linear algebra and its applications. This will enable the student to not only understand but also apply linear algebra in solving practical engineering problems. Skills in linear algebra are of high importance when dealing with scientific computing, image processing graphics, robot technology, algorithmics, coding theory, and more. As an example, the founders of Google have cited their course in linear algebra as the backbone of Google's PageRank feature (i.e. ordering web pages after importance). The course familiarizes students with scalars, vectors, matrices, determinants, operations on vectors and matrices, and systems of linear equations in matrix form. The course also presents applications of matrix theory to linear models, including examples from engineering.

Knowledge

After successfully completing the course, the student will have gained knowledge about:

- What a vector space is
- How a linear representation of such spaces can be analysed using matrix operations
- Application of linear algebra in engineering

Skills

After successfully completing the course, the student will be able to:

- Apply techniques and results from linear algebra to solve problems in linear systems, matrices, vector space, orthogonality, eigen vectors, and eigenvalue
- Apply theory to analyse basic theoretic tasks within the below mentioned topics
- Express mathematically correct arguments
- Use mathematical terminology and symbol language

Competences

After successfully completing the course, the student will have acquired competences in:

- Applying linear algebra to the study of various phenomena in engineering science
- Using matrices to solve concrete problems
- Using vector operations to solve concrete problems
- Applying methods and results from linear algebra in the solution of engineering problems

Topics

Systems of linear equations and their solutions

Matrix algebra

Determinants

Vector spaces

The eigenvalue problems

Orthogonality

Singular value decomposition

Teaching methods and study activities

The total workload is expected to be around 120 hours.

Exam

Exam prerequisites:

None

Type of exam:

Written exam (four hours) consisting of two parts:

- The first part is a Flowlock exam in WISEflow, three hours.
- The second part is a WISEflow exam without Flowlock, one hour.

The second part must be completed in the Jupyter Notebook environment, and the answers must be submitted in WISEflow.

The student will not be able to access the second part before the first part is concluded.

The final grade will be based on an overall assessment of part 1 and part 2.

Internal assessment

Tools allowed:

In the first part the students are allowed to use any notes, books, and/or other written/printed material and will have access to pdf files on their laptop.

In the second part all supplementary materials and aids are allowed, e.g., using a computer as a reference work.

It is not allowed, however, to use AI-tools such as CoPilot, ChatGPT, Bing, etc. as per the general VIA rules.

Communication of any sort is not allowed during the exam and will lead to expulsion of all involved parties from the exam.

Re-exam:

Re-exams may be oral.

Grading criteria

Grading according to the 7-point grading scale.

Responsible

Richard Brooks (rib)

Valid from

01-02-2026

Course type

Elective for Software Engineering

Valgfag for Softwareingeniør