Computational Linear Algebra, 8.0 credits

Computational Linear Algebra, 8.0 hp

Third-cycle education course

6FMAI13

Department of Mathematics

Valid from: First half-year 2023

Approved by
Head of Department

Approved

Registration number

Entry requirements

At least one course in linear algebra and knowledge about Matlab programming.

Contents

The course is intended to give insight into the most important algorithms and techniques from computational linear algebra.
For dense matrices: Implementation of basic operations, such as matrix-matrix multiplication and the LU decomposition, including symmetric, block variants, and updating formulas. Reflections and rotations. Theory and algorithms for computing: the QR-, SVD-, and eigenvalue decompositions.
Applications are used to illustrate the theory and algorithms. Applications include linear least squares problems with constraints, analysis and regularization of ill-conditioned linear systems, total least squares, and pattern recognition.
For sparse matrices: Iterative methods for solving linear systems of equations, including classic and Krylov subspace methods. Preconditioning. Sparse approximate inverse. Incomplete LU-decompositions. Methods for computing eigenvalues, singular values, and solving least square problems, for sparse matrices.

Educational methods

The material is presented during lectures.

Examination

Assignments and mandatory computer exercises.

Grading

Two-grade scale

Course literature

1. Gene H. Golub and Charles F. Van Loan, Matrix Computations, Johns Hopkins Studies in Mathematical Sciences (3rd Ed.), 2) Yousef Saad, Iterative Methods for Sparse Linear Systems, SIAM (2nd Ed.), 3) Lecture notes distributed during the course