### Summary
This course provides an overview of advanced techniques for solving large-scale linear algebra problems, as they typically arise in applications. A central goal of this course is to give the ability to choose a suitable solver for a given application.

### Content

**Introduction**
Sources of large-scale linear algebra problems. Recap of required linear algebra concepts.

**Eigenvalue problems**

**Linear systems**
Direct sparse factorizations. Krylov subspace methods and preconditioners.

**Matrix functions**
Theory and algorithms.

### Keywords
linear systems, eigenvalue problems, matrix functions

### Learning Prerequisites

**Required courses**
Linear Algebra, Numerical Analysis

### Learning Outcomes
By the end of the course, the student must be able to:

- Choose method for solving a specific problem.
- Prove the convergence of iterative methods.
- Interpret the results of a computation in the light of theory.
- Implement numerical algorithms.
- Describe methods for solving linear algebra problems.
- State theoretical properties of numerical algorithms.

### Teaching methods
Ex cathedra lecture, exercises in the classroom and with computer

### Expected student activities

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**MATH-453**

**Computational linear algebra**

Kressner Daniel

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Attendance of lectures.
Completing exercises.
Completing a miniproject.
Solving problems on the computer.

Assessment methods
Miniproject and oral examination.
Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Resources

Bibliography
Lecture notes will be provided by the instructor. Complimentary reading:

Ressources en bibliothèque
- Finite elements and fast iterative solvers / Elman
- Matrix computations / Golub
- Iterative methods for sparse linear systems / Saad

Moodle Link
- https://go.epfl.ch/MATH-453