# Computational linear algebra

Kressner Daniel

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<thead>
<tr>
<th>Cursus</th>
<th>Sem.</th>
<th>Type</th>
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<td>Computational science and Engineering</td>
<td>MA2, MA4</td>
<td>Opt.</td>
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<tr>
<td>Data Science</td>
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<tr>
<th>Language</th>
<th>Credits</th>
<th>Session</th>
<th>Semester</th>
<th>Exam</th>
<th>Workload</th>
<th>Weeks</th>
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<tr>
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<td>5</td>
<td>Summer</td>
<td>Spring</td>
<td>Written</td>
<td>150h</td>
<td>14</td>
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### 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
Lectures + exercise sessions

Expected student activities
Students are expected to attend lectures and participate actively in class and exercises. Exercises will include both theoretical work and programming assignments. Students also complete substantial projects (possibly in small groups) that likewise include theoretical and numerical work.

Assessment methods
50% of the grade will be based on projects, 50% of the grade will be based on a written exam

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