### Cursus

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<th>Cursus</th>
<th>Sem.</th>
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<tr>
<td>Civil &amp; Environmental Engineering</td>
<td>Obl.</td>
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### Contact
- Language: English
- Credits: 4
- Exam: Project report
- Workload: 120h
- Hours: 56
  - Lecture: 18
  - Practical work: 38
- Number of positions: 40

### Frequency
Every year

### Remark
Next time: Fall 2023

### Summary
The students will acquire a solid knowledge on the processes necessary to design, write and use scientific software. Software design techniques will be used to program a multi-usage particles code, aiming at providing the link between algorithmic/complexity, optimization and program designs.

### Content
- Object Oriented Paradigm
- C/C++ and Python programming (class, operator, template, design patterns, STL)
- Programming techniques, code factorization
- Pointers, memory management, data structures
- Linear system solving (Eigen library)
- C++/Python coupling (pybind)
- Post-treatment: Paraview, numpy/scipy, matplotlib

Classical problems: series calculations, solar system and many-body calculation, sparse linear algebra.

### Keywords
- programming, scientific, code design, algorithm, optimization, analysis

### Learning Prerequisites

#### Required courses
- Basis in programming languages (C/Fortran)
- Basic Linux knowledge is required

#### Important concepts to start the course
A Linux laptop is required for this class

### Expected student activities
Exam: 4 evaluated homeworks
Resources

Moodle Link

• https://go.epfl.ch/MATH-611