

MATH-611

**Scientific programming for Engineers**

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Cursus	Sem.	Type
Civil & Environmental Engineering		Obl.
Electrical Engineering		Opt.
Mechanics		Opt.

Language of teaching	English
Credits	4
Session	
Exam	Project report
Workload	120h
<b>Hours</b>	<b>56</b>
Courses	18
TP	38
<b>Number of positions</b>	<b>40</b>

**Frequency**

Every year

**Remark**

Next time: Fall 2024

**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>