Scientific programming for Engineers

MATH-611

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<th>Cursus</th>
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<td>Civil &amp; Environmental Engineering</td>
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Language of teaching: English

Credits: 4

Session: Project report

Exam: 4 evaluated homeworks

Workload: 120h

Hours:
- 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