



## ***Programming, Numerics and Optimization***

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The students will obtain a broad picture of commonly used numerical techniques for linear systems, ordinary differential equations and (structural) optimization. They will achieve a general understanding of the internals/pitfalls of frequently used functions of mathematical/engineering software packages. As a result, they should be able to use these functions more consciously and less in a black-box manner. In their practice, the students will sooner or later encounter problems that are too large, too fine or that run too slow to be fully coded using standard mathematical software packages (Matlab, Mathematica, Scilab, etc.). The course will prepare the students for solving such problems in general-purpose programming languages.

### **Main topics:**

1. Introducing the principles of numerical computations (conditioning, stability, etc.) and selected numerical techniques for linear systems and ordinary differential equations.
2. Providing an overview of optimization techniques and introducing selected optimization algorithms.
3. Introducing basics of optimization techniques in structural engineering, including commonly used methods of sensitivity analysis.
4. Providing a foundation for implementing some of these techniques in any programming language (C/C++ is used within the course).

**The total number of lecture hours: 30, laboratory exercises: 0 hours, self-teaching: 40, direct tutoring and consultations: 15 hours.**

**ECTS Points: 3**