

Numerical Methods and Stochastics					
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Module number CE-WP08/SE-CO-8/NMS	Credits 6 CP	Workload 180 h	Semester[s] 2. Sem.	Duration 1 Semester[s]	Group size no limitation
Courses a) Numerical Methods and Stochastics			Contact hours a) 4 WLH (60 h)	Self-study a) 120 h	Frequency a) each summer
Module coordinator and lecturer(s) Prof. Dr. Martin Kronbichler a) Assistants, Prof. Dr. Martin Kronbichler					
Admission requirements Recommended previous knowledge: Basic knowledge of: partial differential equations, numerical methods and stochastics					
Learning outcome, core skills Students should become familiar with modern numerical and stochastic methods After successfully completing the module, the students <ul style="list-style-type: none"> • should be able to formulate and analyze data from a probabilistic perspective, • should understand the theoretical aspects of FEM and FVM methods, • should be familiar with modern iterative solvers for large systems of linear equations and their necessity for numerical PDE solving, • should be familiar with standard methods for solving optimization problems. 					
Contents a) Numerical Methods: <ul style="list-style-type: none"> • Boundary value problems for ordinary differential equations (shooting, difference and finite element methods) • Finite element methods (brief retrospection as a basis for further material) • Efficient solvers (preconditioned conjugate gradient and multigrid algorithms) • Finite volume methods (systems in divergence form, discretization, relation to finite element methods) • Nonlinear optimization (gradient-type methods, derivative-free methods, simulated annealing) Stochastics: <ul style="list-style-type: none"> • Fundamental concepts of probability and statistics, such as random variables, univariate distributions & densities, descriptive statistics, parameter estimation, & law of large no • Regression, such as univariate and multivariate linear regression, least-squares estimation, data transformations, qualitative predictors, and regularization • Exploratory data analysis, such as qq-plots and summary statistics 					
Educational form / Language a) Tutorial (1 WLH) / Lecture (3 WLH) / English					

Examination methods

- Written exam 'Numerical Methods and Stochastics' (180 min., Part of modul grade 100 %)

Requirements for the award of credit points

- Passed final module examination

Module applicability

- M.Sc. Computational Engineering
- M.Sc. Civil Engineering
- M.Sc. Subsurface Engineering

Weight of the mark for the final score

Percentage of total grade [%] = $6 * 100 * \text{FAK} / \text{DIV}$

FAK: The weighting factors can be taken from the table of contents.

DIV: The values can be taken from the table of contents.

Further Information