

Numerical Methods and Stochastics					
Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-WP08/NMS	6 CP	180 h	2 nd Sem.	Summer term	1 Semester
Courses Nuerical Methods and Stochastics			Contact hours 4 SWS (60 h)	Self-Study 120 h	Group Size: No Restrictions
Prerequisites Basic knowledge of: partial differential equations, numerical methods and stochastics					
Learning goals / Competences 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. 					
Content <i>Numerical Methods:</i> <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) <i>Stochastics:</i> <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 					
Teaching Methods / Language Lectures (3h / week), Exercises (1h / week) / English					
Mode of assessment Written examination (180 min, 100%)					
Requirement for the award of credit points Passed final module examination					
Module applicability MSc. Computational Engineering, MSc. Bauingenieurwesen					
Weight of the mark for the final score 6 %					
Module coordinator and lecturer(s) Prof. Dr. M. Weimar, Prof. Dr. J. Lederer, Assistants					
Further information					