

Numerical Simulation in Geotechnics and Tunneling					
Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-WP09/NSGT	6 CP	180 h	2 nd Sem.	Summer term	1 Semester
Courses			Contact time	Self-study	Group Size
a) Numerical Simulation in Tunneling			2 h/week	60 h	No Restrictions
b) Numerical Simulation in Geotechnics			2 h/week	60 h	
Prerequisites					
Fundamental knowledge in soil mechanics and FEM					
Learning goals / Competences					
After successfully completing the modules, the students are able to					
<ul style="list-style-type: none"> • implement numerical models of complex boundary value problems of tunnels and geotechnics, creating the adequate geometrical models, • evaluate numerical models and their results in a critical way, • acquire adequate knowledge in fundamentals of the finite element method to be able to adopt numerical simulation in design and control of geotechnical problems with focus on the interactions between the soil and structures. 					
Content					
a) Numerical Simulation in Tunneling					
The course deals with the numerical modeling of tunnel structures and tunnel driving:					
<ul style="list-style-type: none"> • basic aspects of numerical modeling of tunnel construction problems • practical application of FE software environments to model a tunnel advance in 3D • automatic and parameter-controlled generation of complex models 					
b) Numerical Simulation in Geotechnics					
The course deals with the numerical modeling of geotechnical structures and construction methods:					
<ul style="list-style-type: none"> • Overall insight to the numerical simulation of geotechnical problems by using the finite element method • Details for proper simulation in geomechanics by addressing constructional details, optimum discretization, boundary and initial conditions • Quick review of simple constitutive models, including calibration and discussion of important criteria to choose relevant constitutive models for distinct applications • Methods to validate and verify the reliability of numerical models by exploring the numerical outputs in space and time and the evaluation of numerical results • The soil-water interactions in drained, undrained and consolidation analyses, fully coupled hydromechanical finite element solutions • Creation of models, execution of calculations and analysis of results for various geotechnical structures: shallow foundations, retaining walls, excavation, embankments, consolidation, slope failure • Fundamentals of contact elements and their applications in geotechnical modeling • Introduction to FE simulations with Plaxis 2D and other FE programs (Abaqus, Numgeo, etc.) • Brief overview of other numerical methods (e.g. DEM, MPM, boundary element method) 					
Teaching methods / Language					
a) Lectures (2 h/week) / English b) Lectures (2 h/week) / English					

Mode of assessment
Final written exam in the computer lab (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. techn. G. Meschke, Dr.-Ing. B. T. Cao, Dr. A. A. Lavasan, Assistants
Further information