Numerical Simulation in Geotechnics and Tunneling

Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-WP09/NSGT	6 CP	180 h	2nd Sem.	Summer term	1 Semester

Courses	Contact time	Self-study	Group Size
Numerical Simulation in Geotechnics and Tunneling	4 SWS (60 h)	120 h	-

Prerequisites

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Learning goals / Competences

After successfully completing the module, the students are able to

implement numerical models of complex boundary value problems in geotechnical engineering and tunneling, 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 or tunneling problems with focus on the interactions between the soil and structures.

Content

The course deals with the numerical modeling of various geotechnical structures and tunnels:

- Overall insight to the numerical simulation of geotechnical problems by using the finite element method and concise review of simple constitutive models
- Introduction to Hardening Soil (HS) and Hardening Soil Small Strain (HSS) model and calibration of constitutive parameters of the HS and HSS model
- Simulation of lab tests and optimization of constitutive parameters
- Details for proper simulation in geotechnics by addressing constructional details, optimum discretization, boundary and initial conditions
- Fundamentals of contact elements and their applications in geotechnical modeling
- Considering water pressures in numerical simulations: soil-water interactions in drained, undrained, consolidation, and fully coupled hydromechanical analyses
- Creation of models, execution of calculations and analysis of results for various geotechnical boundary value problems: shallow foundations, retaining walls, excavation, embankments, consolidation, slope failure, tunneling
- 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
- Introduction to FE simulations with Plaxis 2D and numgeo
- Introduction to Finite Element Limit Analysis (FELA) and the FE software OptumG2
- Comparison of Plaxis2D, numgeo and OptumG2 for different boundary value problems
- Brief overview of other numerical methods (e.g. DEM, MPM, boundary element method)

Teaching methods / Language

Lectures (4 h/week) / English

Mode of assessment

Final written exam (180 min.)

Requirement for the award of credit points

Passed final module examination

Module applicability MSc. Computational Engineering, MSc. Bauingenieurwesen, MSc. Subsurface Engineering
Weight of the mark for the final score 6 %
Module coordinator and lecturer(s) Prof. Dr.-Ing. habil. T. Wichtmann (coordinator), Dr.-Ing. C. Schmüdderich
Further information