

Advanced Constitutive Models for Geomaterials					
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Module number BI-WP44 /SE-CO-10/CE-W06	Credits 6 CP	Workload 180 h	Semester[s] 2. Sem.	Duration 1 Semester[s]	Group size no limitation
Courses a) Advanced Constitutive Models for Geomaterials			Contact hours a) 4 WLH (60 h)	Self-study a) 120 h	Frequency a) each summer
Module coordinator and lecturer(s) Prof. Dr.-Ing. Torsten Wichtmann a) Dr.-Ing. Christoph Schmüdderich, Dr.-Ing. Merita Tafili					
Admission requirements					
Learning outcome, core skills After successfully completing the module, the students are able to <ul style="list-style-type: none"> • model the material behavior of soil using suitable, advanced constitutive models, • select suitable numerical methods and constitutive models for practical questions and assess limitations according to the selected approaches, • calibrate the parameters of the advanced constitutive models and evaluate the model performance based on single integration point simulations 					
Contents a) The course deals with the introduction of advanced soil mechanical behavior and appropriate constitutive models allowing to capture advanced effects. Model formulations and parameter calibration for different soil model families are taught. In addition, an introduction to single integration point finite element simulations with Incremental Driver (ID) is provided and simulations of different laboratory tests are conducted with ID using different elasto-plastic and hypoplastic constitutive models. Advanced soil mechanics: <ul style="list-style-type: none"> • Critical state soil mechanics • Crushable soil mechanics • Unsaturated soil mechanics • Soil memory effects and their modelling • Clay structure and small-strain stiffness anisotropy • Influence of temperature on soil behavior and its modelling Sophisticated constitutive models for soils: <ul style="list-style-type: none"> • Modified Cam-Clay model • Sanisand • Hypoplasticity with Intergranular Strain • Clay Hypoplasticity • Hypoplasticity for crushable soils • Visco-hypoplasticity 					

<ul style="list-style-type: none">• Barcelona Basic Model
Educational form / Language a) Lecture (4 WLH) / English
Examination methods <ul style="list-style-type: none">• Written exam 'Advanced Constitutive Models for Geomaterials' (180 min., Part of modul grade 100 %)• Optional homework to achieve bonus points for the written exam
Requirements for the award of credit points <ul style="list-style-type: none">• Passed final written exam
Module applicability <ul style="list-style-type: none">• M.Sc. Civil Engineering• M.Sc. Subsurface Engineering• M.Sc. Computational 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