

IGT-Kolloquium

Tuesday, 30 April 2024

Soil Cyclic Liquefaction from Macro to Micro: Advances in Continuum and Particle Scale Modeling

Prof. Mahdi Taiebat, University of British Columbia, Vancouver
16:30 - 17:30 Uhr, ETH Zurich, Hönggerberg, HIL E 4

Recent developments within the Theoretical & Applied Geomechanics (TAG) research group at UBC regarding modeling the phenomenon of cyclic liquefaction in granular soils will be presented and discussed. The presentation will share the highlights of these developments at the continuum modeling scale and particle scale. On the continuum modeling scale, the focus will be on recent developments in the SANISAND constitutive model framework. Specifically, the new formulation includes <memory surface> and <semifluidized state> constitutive ingredients that deal with the simulation of pre- and post-liquefaction, and the <shear stiffness enhancement> constitutive ingredient for the simulation of non-zero mean shear stresses, all within the context of cyclic liquefaction response. Examples of model calibration, validation, and application in boundary value problems involving the cyclic liquefaction phenomenon will be presented and discussed. At the discrete element level, the presentation focuses on the micromechanical descriptors relevant to understanding the granular material response in the process of transition to liquefaction in cyclic shearing. It will also discuss the findings related to the effects of both particle size distribution and particle shape on the cyclic liquefaction resistance of granular systems. The collective study contributes to advancing the modeling of seismic liquefaction-induced displacements, enhancing predictive accuracy for geotechnical risk assessment and mitigation strategies.

Dr. Mahdi Taiebat is a Professor and Associate Head of Civil Engineering at the University of British Columbia in Vancouver, Canada. He received his Ph.D. from the University of California at Davis in the USA, and his M.Sc. and B.Sc. from Iran's Sharif University. His contributions to geotechnical research, professional practice, and education are primarily in theoretical and computational geomechanics, focusing on constitutive modeling and applications in geotechnical earthquake engineering. He leads the Theoretical & Applied Geomechanics (TAG) research group at UBC, has mentored over 30 graduate students and postdoctoral fellows, and co-authored over 150 scientific papers. He serves on the ISSMGE Technical Committees on Numerical Methods TC103 and Earthquake TC203, the ASCE Technical Committee on Earthquake Engineering and Soil Dynamics, and the Editorial Boards of Soils and Foundations Journal, Geotechnique Letters, and Soil Dynamics and Earthquake Engineering Journal. He received the UC Davis Excellence in Geotechnical Engineering Award, the UBC Professor Appreciation Award, the ASCE Norman Medal, and the NSERC Discovery Accelerator Award. He spent a postdoctoral year at the NGI in 2008-09, and a sabbatical year at MIT in 2015-16.

