a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Postdoctoral Openings in Computational Geomechanics

Project Summary

Several case histories of tailings dam failure have signified the importance of thorough characterization of tailings material for moving from conventional limit-equilibrium analysis to modern stress-deformation analysis. The main ingredients of the latter are adequate constitutive models for the stress-strain response of tailings and a robust calibration process for the parameters of such models. Exciting advances in the constitutive modeling of geomaterials are expected to allow for the stress-deformation analysis of tailings dams when subjected to different triggers. The calibration of the constants and initial values of state variables in such advanced models is based on element-level monotonic and cyclic triaxial or simple shear tests. However, tailings are mainly characterized using Cone Penetration Test (CPT). We need to link the CPT data to the calibration of the model parameters. Adopting technics that use both element-level and in-situ testing data in the calibration process would be of great value in paving the path for the use of realistic soil models.

This project aims to develop an inverse analysis technique to characterize selected material model parameters based on CPT data. A reliable and robust model of cone penetration testing will be developed using the Material Point Method (MPM) and/or Particle Finite Element Method (PFEM). A nonlinear constitutive model will be used for simulating the brittleness and anisotropy of tailings material. The constitutive model and the modeling approach will be thoroughly verified and validated. Then, a synthetic database of key soil constitutive model parameters and the corresponding CPT data will be compiled, based on which an algorithm using Machine Learning (ML) techniques will be developed to link the model parameters and CPT measurements. Using actual CPT measurements of tailings material, the trained algorithms will then be used for inverse calculation of selected key model parameters and state parameters, which are essential for the modern stress-deformation analysis of tailings storage facilities.

Position Description

The selected candidate will join the Theoretical & Applied Geomechanics research group at the University of British Columbia, working under the supervision of Prof. Mahdi Taiebat. The position involves a one-year appointment, with the possibility of a contract extension after this period. It is available from January 1st, 2023 or upon agreement. The selected candidate is expected to implement advanced constitutive laws, conduct numerical analyses with MPM/PFEM computational techniques, and apply ML techniques for inverse analysis. Competitive salary, exposure to a dynamic international environment, and opportunities for professional development will be essential elements of the employment conditions.

Selection Criteria

- PhD in Geomechanics, Mechanics, or related fields.
- Excellent computational and programming skills.
- Expertise in MPM and/or PFEM computational methods.
- Excellent knowledge of continuum mechanics and familiarity with constitutive modeling.
- Excellent communication skills.
- Ability to work independently and in teams. Co-supervision of graduate students is expected.

The review of candidates will begin on December 1st, 2022. Applications will be accepted until the position is filled.

How to Submit Your Application

Please, forward a single PDF consisting of a 1-page cover letter describing interests and qualifications for the position, a complete curriculum vitae, contacts of two references, and two representative publications to Prof. Mahdi Taiebat (mtaiebat@civil.ubc.ca).