Universität Stuttgart

IGS

Soil-water-structure interaction applications using dynamic Material Point Method (MPM)

Geotechnical applications such as landslides, water-structure interaction, slope failure and installation of pile involve large deformation and material movement in the soil region. Conventional Finite Element Method (FEM) is known for structural analysis involving solid bodies with small deformation. Here, mesh distortion is observed during large deformation whereas in MPM, the bodies are composed of finite particles which flow over a fixed computational grid. This procedure eliminates the problem of mesh distortion during large deformation of the material.

Further, the complex behavior of soil has to be modeled with reliable constitutive models. This should enable us to capture the real behavior during loading, unloading and failure. Then a robust contact algorithm is necessary to provide interaction between the soil and structure. Together with these, it is possible to simulate the geotechnical applications.

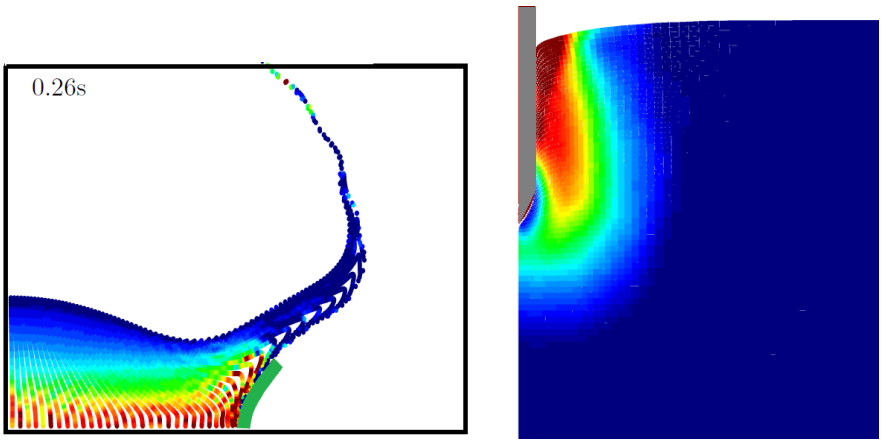

Figure: Water-Structure Interaction (left) and void ratio distribution during pile installation (right)

Possible master and bachelor thesis topics:

- Simulation of pile installation considering different installation methods to study the effect on soil.
- Formulation and implementation of absorbing boundaries for pile installation problems.

Requirements:

1. FEM formulation and use of any commercial FEM software.
2. Soil mechanics and Continuum mechanics.
3. Basic programming in C++ and/or FORTRAN.

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