

## MASTER'S THESIS

### Discrete element modeling of grain crushing effects

#### Areas of interest

Geotechnical engineering, Numerical methods, Discrete element methods

#### Duration

It is possible to finish the thesis within six months.

#### When?

The student is encouraged to start as soon as possible; nevertheless, a later start date can be agreed on.

#### Project description

During mechanical loading, some of the brittle soil particles will break into smaller pieces, which changes the material properties of the soil. This is known as the grain crushing effect. Grain crushing effect is important for soil mechanics. However, since grain crushing takes place in microscale, it is very difficult to observe, measure or model this effect. Also, it remains an open question: to what extent the grain crushing will affect the macroscale properties of the material?

Discrete element method (DEM) is a numerical method for computing the motion and effect of a large number of small particles. It is becoming widely accepted as an effective method of addressing engineering problems in granular and discontinuous materials. Since DEM is able to model the microscale properties of the granular materials, it is suitable to be applied for modeling grain crushing effects.

We have developed a new algorithm to model grain crushing effects with DEM. Further improvement and testing of this algorithm for different loading cases will be the main topic of this master thesis. The modeling results should be

compared to the experimental and continuum modeling results in literatures.

This will be supported by a cooperation project with BOKU and TU Graz. Commercial DEM software PFC 2D and 3D will be used.

The student applying for this master thesis should have basic knowledge of soil mechanics and numerical modeling. Experience in DEM modeling is preferred, but not compulsory.

By working on this master thesis, the student will learn to use DEM to model many different loading cases and have a better understanding on grain crushing effects and soil mechanics.

#### Methodology

- Literature review. Understanding of the grain crushing problems
- Learn DEM and the software PFC 2D and 3D
- Modeling different problems in DEM with grain crushing effects
- Compare the results
- Writing the thesis

#### What can you expect from this research work?

We provide good supervision and assistance in developing the models.

#### Interested? Please contact us.

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