Graz University of Technology
Institute of Rock Mechanics and Tunnelling

Masterproject (MP, 5 ECTS)

Title **Numerical Modelling of Rock Bridges**

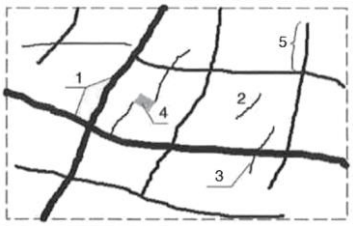
Description

Rock falls occur, when a block or several blocks loose the contact to the competent rock mass and completely detach. The exact time of this event cannot be predicted since the detachment plane is inaccessible and invisible. It is also unknown whether the block(s) are already completely detached or if there are still some rock bridges left, that stabilize the block. But these rock bridges are prone to erosion and a failure of them finally leads to the rock fall event.

With discrete element modelling methods (e.g. UDEC, 3DEC) discontinuities can be considered explicitly. For the force-deformation behaviour of joints several constitutive laws are implemented in such discrete element modelling tools. UDEC for example provides following relationships:

- Elastoplastic Mohr-Coulomb failure criterion
- Continuously yielding joint model
- Barton-Bandis joint model

Still, neither with UDEC nor with 3DEC or other conventional discrete element modelling tools it is possible to simulate failure and shearing of rock bridges (definition see figure below, according to [1]) and, consequently, the opening of a discontinuity at a rock bridge.



(1) multiply connected persistent) fractures
(2) isolated fractures
(3) dead-end fractures
(4) rock bridges
(5) dead-end segments of persistent fractures

These rock bridges shall be investigated with the numerical DEM software 3DEC (depending on the availability at the institute) under consideration of the different constitutive laws. The following questions are to be treated as part of the work:

- How can rock bridges be modelled/approximated within the numerical model?
- How can the failure due to erosion/shear loading be implemented in this model?

The elaboration of this project consists of the following steps:

- Literature research on modelling of rock bridges (resp. progressive failure of rock slopes)
- Preparation of a work plan and a task schedule with mile stones
- Development of an approach to model rock bridges
- Verification of the constitutive laws with respect to their applicability
- Writing a scientific report with the results of the analysis.

Templates for the scientific report can be found on the institute's homepage. There is also a guideline for scientific writing free downloadable at the homepage, whose compliance is mandatory. The language for the report can either be in English or in German.

Supervisor	Start	Duration	Contact
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Literature: [1] Jing, L. & Stephansson, O. 2007. Fundamentals of Discrete Element Methods for Rock Engineering – Theory and Applications. Developments in Geotechnical Engineering, No. 85. 1st edition. Elsevier: Amsterdam.