Technische Universität Graz
Institut für Felsmechanik und Tunnelbau

Masterproject (MP, 5 ECTS)

Estimation of Persistence and Detection of Rock Bridges in Digital Images

The persistence describes the lateral extension and size of discontinuities in an infinite plane If discontinuities are non-persistent, they can be separated by so called rock bridges. A rock bridge is defined as a small bridge of intact rock separating coplanar or non-coplanar discontinuities [1]. Rock bridges are the link between the geometrical and mechanical properties of discontinuities and rock masses and can increase the global stability of a jointed rock mass significantly [2]. A block can only detach, if he is defined by persistent discontinuities on all sides, which means, that he cannot fall or slide unless an appropriate amount of rock bridges have failed previously [1].In contrast, non-persistent fractures result in lager blocks and stress concentrations in the rock bridges.

However, it is of extreme difficulty to prove the existence of rock bridges in an out crop/rock face, determine their extent and percentage on the overall failure plane and, above all, to gain information about their (residual) strength. The persistence can for example be estimated by the trace length, by comparing the sum of individual joint surface areas to the surface of a coplanar reference area.

This thesis focuses on the determination of the trace lengths in scaled 2D images to estimate the length of persistent fractures in blocky rock masses [3]. The thesis is oriented on the following questions:

- How can linear features, like fractures be detected in digital images of rock faces
- Can these linear features be used to detect rock bridges?

Methodology:

- Preparation of a work plan and a task schedule with mile stones
- Literature research on persistence, rock bridges and line detection in 2D images
- Elaboration of a MATLAB code to detect linear features/fractures in 2D images
- Calculation of the persistence and global distribution of rock bridges in the rock face
- Writing a scientific report with the results

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.

References:

[1] Kim BH, Cai M, Kaiser PK, Yang HS. Estimation of Block Sizes for Rock Masses with Non-persistent Joints. Rock Mech. Rock Engng. 2007;40(2):169–92.

[2] Cai M, Kaiser PK, Uno H, Tasaka Y, Minami M. Estimation of rock mass deformation modulus and strength of jointed hard rock masses using the GSI system. International Journal of Rock Mechanics and Mining Sciences 2004;41(1):3–19.

[3] Lemy F, Hadjigeorgiou J. Discontinuity trace map construction using photographs of rock exposures. International Journal of Rock Mechanics and Mining Sciences 2003;40(6):903–17.

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Start by arrangement

Duration ca. 125 h

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