# Master project (MP, 5 ECTS)

Working title   Digitalization of a rough surface using recent mapping tools

Description

In 2015, Poturovic [1] performed several direct shear tests on artificial joint surfaces. To allow a comparison of results of different test runs, moulds of a single rock joint surface have been prefabricated using silicone. These moulds were used to produce multiple test samples made of mortar with identical surfaces:
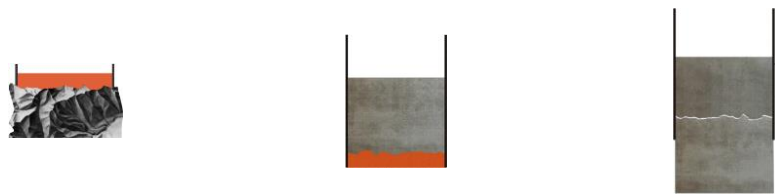

For the evaluation of the capability of numerical software (e.g. Phase2, Flac3D, UDEC, 3DEC) to simulate direct shear tests in a reliable way, we plan to model the tests performed by Poturovic [1] numerically. Therefore, the surface of the joints and of the moulds, respectively, have to be digitalized. Several tools and packages may be suitable for this task:

- Laser scanning
    - ATOS (www.capture3d.com)
    - Terrestrial Laser Scanning
- Photogrammetry
    - Agisoft PhotoScan (www.agisoft.com)
    - ShapeMetriX3D (www.3gsm.at)

At least two different tools should be used in order to digitalize the surface of the moulds. The result of the digitalization should be a 3D point cloud. The point clouds of each method shall be analysed with respect to their accuracy. Potential limitations of the used methods have to be highlighted.

Master project →
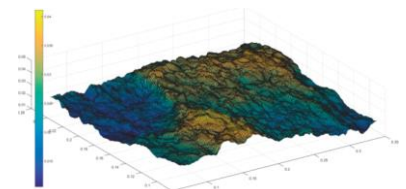
Source: Bitenc et al. [2]

Collaboration with other institutions (e.g. Institute of Applied Geosciences, Institute of Computer Graphics and Vision), which have already access to a lot of experience in this domain of research, is desired. Matlab or any other suitable program shall be used to work on the point cloud data. Optional a code shall be written, which modifies the point cloud data in a way that it can be directly imported into a three-dimensional numerical modelling program (e.g. FLAC3D, 3DEC) as a 3D element surface suitable for meshing.

Requirements   Good skills in Matlab or similar coding tools

Supervisor   Dipl.-Ing. Alexander Kluckner
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Start / Duration   Immediately / max. 120 hours

Literature   [1] Poturovic, S. 2015. Vergleichende Untersuchungen zu CNL (Constant Normal Load) und CNS (Constant Normal Stiffness) Direktscherversuchen. Master's thesis. Graz University of Technology, Austria.

[2] Bitenc, M., Kieffer, D.S. and Khoshelham, K. 2015. Estimating joint roughness using wavelet-based denoised terrestrial laser scanning data. In: *Proceedings of the ISRM Regional Symposium EUROCK 2015 & 64th Geomechanics Colloquium - Future Development of Rock Mechanics*, Schubert, W. & Kluckner, A. (eds), Salzburg, Austria, 7.-10. October 2015, pp. 517-522. Austrian Society for Geomechanics: Salzburg.