Graz University of Technology
Institute of Rock Mechanics and Tunnelling

# **Master's Thesis** (MA, 30 ECTS)

## Generation of a realistic 3DEC model basing on a 3D rock face model

### Description

Numerical models are widely used in geotechnical engineering. However, every model only approximates the actual conditions on-site and hence induce an accepted error. For example, a natural rock face is usually represented by a vertical or inclined plane without surface irregularities caused e.g. by out breaks of joint bodies. With the possibility to generate scaled 3D rock face models (e.g. by laser-scanning or computer vision) this well accepted error should be avoidable. Additionally, it is also possible to map and characterize the geometrical properties of a digitized outcrop with a high degree [1, 2], but how can the 3D surface information be translated into a realistic numerical model?

In this thesis an approach shall be elaborated to find a routine which generates a realistic 3DEC model of a tunnel face. For this, the following questions shall be treated:

- Is it possible to approximate a real rock face in 3DEC by extruding polyhedrons generated by discontinuities?
- How many discontinuities are at least necessary to generate a realistic rock face with 3DEC?
- How can the approximation be expressed statistically (e.g. deviation of a 3DEC plane from the related actual point cloud)?
- What criterion should be applied to include/exclude or assume discontinuities in the rock face model?

### Methodology

- Literature research
- Geotechnical mapping/characterization of a series of rock faces using DES (Discontinuity Set Extractor) ShapeMetriX3D and CloudCompare
- Numerical modelling with 3DEC
- Analysis of the approximation/representativeness of the model
- Writing a technical report with the found 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] Riquelme et al. (2015) Discontinuity spacing analysis in rock masses using 3D point clouds, Eng. Geol 195, p. 185-195; doi: 10.1016/j.enggeo.2015.06.009

[2] Gaich & G. Pischinger 2016. 3D images for digital geological mapping. Geomechanics and Tunnelling 9 (2016), No.1 pp. 45-51; DOI: 10.1002/geot.201500048

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