Geophysical Research Abstracts
Vol. 21, EGU2019-2257, 2019
EGU General Assembly 2019

From surface scan data to shear stress predictions - tools for an easy computation of direct shear tests

Daniel Pötschke and Thomas Frühwirt
Institut für Geotechnik, TU Bergakademie Freiberg, Freiberg, Germany

The shear characteristics of rock joints are important in geotechnical engineering. For crystalline rocks with a very low matrix permeability and a high matrix strength they dominate the permeability and form weakness zones. If one wants to make precise predictions about the integrity of a possible host rock barrier a deep understanding of the processes in a single rock joint is necessary. Even after 50 years of research predicting the shear stress and dilation of a rock joint under shear displacement remains a challenge. This is caused by the uniqueness of rock joint.

Direct shear tests are performed on lab scale granite samples. This allows a detailed observation and control of all parameters which might influence the results. Lab data are used to validate the predictions. Surface scan data of the rock joints are used as main input data. Other inputs are basic rock matrix parameters, rock joint parameters and the boundary conditions of the direct shear test.
Small software tools help to achieve an easy prediction of surface roughness, peak and residual shear stress and dilation. Firstly the surface is transformed into a quadratic grid that allows fast computation. Then the surface roughness is characterized using different commonly used roughness definitions. A variation of different shear laws, semi-analytical approaches and numerical simulations found in literature are offered to calculate shear strength and dilation. Simple models to predict the permeability should follow in a next step.
The focus of a new numerical approach is to reduce the non-physical assumptions and parameters without a physical meaning. Fit parameters which are valid just for a specific set of data are not used. Balancing the external normal force with the reaction force due to sample deformation is the key feature of the new model.

These tools allow to perform predictions of direct shear tests in an easy and fast manner. A set of functions or standalone executables will be made accessible to the scientific community.