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Simulation of a true-triaxial deformation test on anisotropic gneiss using FLAC3D

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A series of true-triaxial experiments have been carried out at the University of Toronto's Rock Fracture Dynamics Laboratory. Isotropic pegmatite and gneiss have been used to systematically study the effect of anisotropy on the strength, behaviour and seismic response. Samples were loaded under true-triaxial stress conditions and subjected to complex loading and unloading histories associated with rock deformation around underground openings. The results show expected patterns of weakness from preferentially oriented samples and highlight the importance of unloading history under true-triaxial conditions on the deformation and seismic response of the samples.
These tests have been used to validate a synthetic simulation using the Itasca FLAC3D numerical code. The paper describes the FLAC3D simulations of the complex true-triaxial loading and unloading history of the different anisotropic samples. Various parameters were created to describe the physico-mechanical properties of the synthetic rock samples. Foliation planes of preferential orientations with respect to the primary loading direction were added to the synthetic rock samples to reflect the anisotropy of the gneiss. These synthetic rock samples were subjected to the same loading and unloading paths as the real rock samples, and failed in the same mechanism as what was observed from the experiments, and thus it proved the validity of this numerical simulation with FLAC3D.