ROLE OF THE DAMAGED ZONE ON THE CONVERGENCE OF STORAGE GALLERIES, NUMERICAL MODELING OF EXPERIMENTS IN THE UNDERGROUND LABORATORY OF BURE

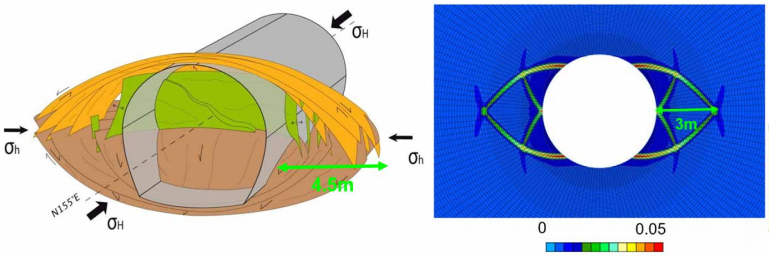
Prof. Frédéric Collin

University of Liège, Belgique

05.07.2019 – 14:45 – IC 03 / 606

Galleries drillings induce damage propagation in the surrounding medium and create the Excavation Damaged Zone in which the material properties are modified. The prediction of the fracture structure within this zone is a major issue especially in the context of underground storage.

In situ observations have highlighted that the damage around galleries is localised and develops mainly as strain localisation in shear band mode. An enhanced model is needed to correctly represent the strain localisation behaviour in numerical computations, the coupled second gradient local model is chosen. In underground structures, air ventilation inside the galleries may lead to rock desaturation close to the wall. This may influence the damage zone structure and is therefore numerically studied. Furthermore, the rock properties changes, such as damage and permeability modification, are considered. They are inspired by micro-macro methods in which the propagation of micro-cracks induces the degradation of the material properties. To illustrate the coupling in unsaturated rocks, a two-dimensional plane strain state hydro-mechanical modelling of a gallery excavation including air ventilation is performed (Lagamine code, ULg). The Callovo-Oxfordian claystone is chosen as host material.



Hydromechanical modelling of the excavated damage zone around storage galleries

The modelling provides information about the fracture structure and evolution around the gallery. It exhibits a chevron fracture pattern with an extension corresponding to in situ experimental measurements of shear fractures. The convergence is well reproduced in the vertical direction and is anisotropic due to the shear strain localisation bands. When ventilation is applied, the desaturation of the rock inhibits the shear strain localisation and reduces the gallery convergence. The influence of the strain localisation on pore water pressures and degree of saturation is also highlighted.

Guests are welcome!