Numerical modelling of the Wedge Splitting Test in rock specimens, using fracture-based zero-thickness interface elements

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ABSTRACT

The purpose of the Wedge Splitting Test (WST) is to generate a stable fracture propagation alogn a pre-established path and be able to measure the specific fracture energy parameter G_F^I , all using simple cylindrical specimens with the appropriate notches [1].

However, the notch dimensions (basically it length) combined with the material parameters, may determine whether the test would be stable or unstable (snap back). In order to make decision on the notch length for a specific rock test, a number of WST experiments were simulated numerically via FEM and fracture-based interface elements. Continuous elements were used represent the rock, the steel loading plates and an "equivalent spring" to the testing machine compliance. The notch and the fracture path on the rock were represented via interface elements. For the continuous elements, isotropic linear elastic materials were assumed. The interface elements representing the notch were equipped with linear elastic constitutive law, with very low elastic stiffness parameters K_n and K_t, so that they do not oppose any significant resistance to opening. The constitutive model used for the interface elements along the fracture path was the elastoplastic constitutive formulation with fracture energy-based evolution laws described in detail in [2].

The model result match very realistically the curves obtained in the experimental WST, allowing us to estimate indirectly, not only the specific fracture energy but also other basic mechanical parameters of the rock, such as the elastic modulus and the tensile strength.

REFERENCES

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