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Failure development around a borehole in an orthorhombic thermo-elastoplastic rock medium

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The elastic anisotropy of a rock medium is one of the main factors affecting stress distribution around the borehole. It governs the initiation and propagation of the technologically induced compressive and tensile failure zones, and reopening of natural mechanical discontinuities.

We conducted a two-dimensional analysis of failure around a pressurized horizontal borehole in an orthorhombic elastic rock medium subject to variable far-field loads. The analytical solution to the thermoelastic problem was derived. An elastoplastic finite element method code was developed using MILAMIN platform (milamin.org) and implemented in MATLAB. Various yield functions were used, including von Mises, Mohr-Coulomb, Drucker-Prager and Hoek-Brown failure criteria. The analysis was augmented by introducing rock heterogeneities and discrete mechanical discontinuities in the vicinity of the borehole.