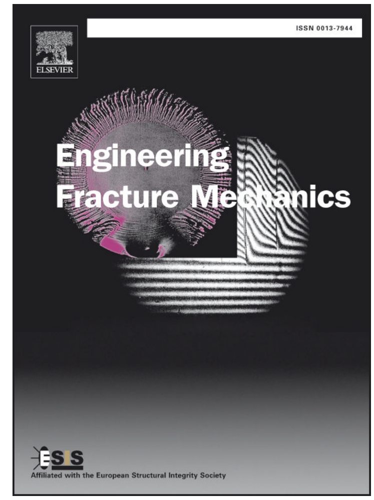

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A microcrack growth-based constitutive model for evaluating transient shear properties during brittle creep of rocks

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Abstract: A novel microcrack growth-based constitutive model is proposed to evaluate the transient shear properties of intact rocks during brittle creep. This process of brittle creep focuses on the steady-state and accelerated stages, in which the initial state during creep is equivalent to the damage state at peak point (ε_{peak}, σ_{1peak}) of stress-strain relation measured by triaxial compression test. The improved stress intensity factor from Ashby and Sammis' model, the subcritical crack growth law and the Mohr-Coulomb failure criterion are implemented in this microcrack growth-based constitutive model by especially combining the experimental results measured by the repeated loading and unloading tests. This improved stress intensity factor is derived by introducing the effect of initial crack angle. The crack growth-, strain- and time-dependent shear properties are studied. Cohesion experiences a long-term steady-state weakening phase, and an accelerated drop; shear strength and internal friction angle both experience a long-term steady-state strengthening phase, and an accelerated drop during brittle creep. Effects of crack angle on shear properties during the progressive and creep failure stages are also discussed. Crack angle has a great influence on the mechanical properties of rocks, which provides a meaning illustration for correlation between microcrack geometries and macroscopic mechanical behaviors.

Keywords: microcrack growth-based constitutive model; transient shear properties; brittle creep; crack angle; fracture