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Static shear fracture influenced by historic stresses path and crack geometries in brittle solids

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Abstract: Historic stress path strongly influences the variations of shear fracture, and crack geometry has a great significance for the mechanical properties of brittle solids (e.g., rock, ceramic, glass, and concrete, rock is the major object in this study) in static compression. In this study, a new analytic method is proposed to predict the effect of historic stress path on static shear properties under different crack angles. An improved stress intensity factor containing crack angle effect is derived by use of the wing crack model. Drawing a relation between crack growth and strain obtained from the correlation of micro and macro damages into this improved stress intensity factor, a crack growth- based stress- strain relation considering crack angle effect is given. Coupling the crack growth-based stress-strain relation, the Mohr-Coulomb failure criterion and the Mohr-Coulomb strain-softening model, an analytic solution describing the variation of shear properties along with the increasing strain at the post- peak area of stress- strain curve is proposed. And then drawing the time-dependent strain caused by subcritical crack growth considering the effect of stress path into this analytic solution, the effects of stress path on variations of shear