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Modeling of Coupling Between Induced Anisotropic Damage and Permeability in Rocks

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In this paper, we present a micromechanics based macroscopic modeling of the coupling between induced anisotropic damage and permeability in brittle rocks. The damage state is represented by a second order tensor. The evolution of damage is determined from a crack propagation criterion. The free enthalpy of cracked solid is deduced from micromechanical considerations. The constitutive equations of anisotropic damage model are then derived from this thermodynamic potential. For the coupling between induced damage and variation of permeability, it is assumed that cracks exhibit normal opening coupled with sliding and propagation due to crack surface asperity. The normal opening is contributing to the variation of permeability of rock. The overall permeability of the REV is obtained by a space integration method taking into account crack opening in each orientation.

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