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A NUMERICAL DAMAGE MODEL FOR INITIALLY ANISOTROPIC MATERIALS

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This work is devoted to numerical modelling of induced damage in an initially anisotropic material. The representative volume element (RVE) of the cracked material is characterized by an initially transversely isotropic solid matrix which is weakened by a family of penny-shaped microcracks. A numerical homogenization method is proposed to estimate the effective elastic properties of the damaged medium. In this homogenization method, the key step is to determine the Hill's tensor which depends on the orientation and shape of microcracks as well as the anisotropic elastic properties of the solid matrix. Based on the numerical integration of the exact Green's function provided by Pan and Chou [1] and an appropriate coordinate frame rotation method proposed by Giraud et al. [2], the proposed numerical method is able to determine the Hill tensor for an arbitrarily oriented microcracks family embedded in a transversely isotropic matrix. By introducing a suitable evolution law of crack density with applied macroscopic strains, the effective properties of damaged material are evaluated as functions of crack density. The proposed numerical damage model is able to study the interaction between the initial anisotropy and oriented microcracks in 3D conditions. Numerical examples are presented and compared with experimental data for a typical sedimentary rock.

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