SM4S_12298

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

A Non-Associative Anisotropic Damage Model for Brittle Materials

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A micromechanically based anisotropic damage model for brittle materials having different tensile-compressive response is proposed. The material is modelled as an elastic isotropic matrix containing a statistically uniform distribution of growing microcracks. Under the simplifying assumption of non-interacting and self-similar propagating flat cracks, a friction-damage coupled model based on two tensor-valued internal variables, representing damage and frictional contact tractions, is derived. The use of a tensor-valued variable for damage, in particular, makes the model to be capable of describing the load-induced anisotropic response of brittle and quasi-brittle materials. In the framework of thermodynamics with internal variables, overall frictional sliding and crack growth criteria with associated flow rules are used to complement the model. The constitutive equations are then applied to analyze the material response to meaningful loading paths. In order to validate the model, limit strength domains for biaxial and triaxial stress states are derived as well.

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