STRESS LIMITING BEHAVIOR OF A SAMPLE IN THE ANTI-PLANE STRAIN NUMERICAL SIMULATION

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Abstract

The determination of the stresses and strains near a crack tip in a body due to loading has important technological ramifications. In the context of classical linearized elastic theory strain has a $1/\sqrt{(r)}$ singularity, where r is the distance from the crack tip. As the linearized theory is derived under the assumption of infinitesimal strains, the results are at odds with the basic tenet of the theory. K. R. Rajagopal previously proposed new class of elastic models. These nonlinear models allow finite bounded strains even for infinite stresses and might be well suited to describe the fracturing of brittle elastic bodies. Although these models have nonlinear constitutive relation they fit into framework of small strain elasticity as they use linearized strain tensor. We study a plate with a V-notch being subject to anti-plane strain. Using Finite element method (FEM) we compare model of classical linearized material to the material belonging to the new class of elastic materials proposed by K. R. Rajagopal. The constitutive relation for the classical model is described by one parameter and for the new nonlinear model there are three parameters. We can control strain bound in nonlinear model by these parameters. Using Airy stress function we derive weak formulation of boundary value problem for FEM. We study both models in terms of stress and strain fields around the tip of V-notch for various parameters and angles of V-notch. As the resulting stress fields are for both models similar we focus on comparison of the strain tensor components between classical and nonlinear models.