SM9S_12798

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

Numerical Analysis of Strain Hardening and Pressure Sensitivity Effects on J-Integral

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Compact tension (CT) specimen testing is used to compute the fracture toughness parameter J-integral for different materials using load-displacement curves. In this work, J is investigated for compact tension specimen for a strain-hardening pressure-sensitive material. For the theoretical work, a lower-bound plastic limit-load analysis is used with linear hardening assumed for the material. Pressure sensitivity, is accounted for by using the Drucker-Prager yield criterion. Analytic expressions for fracture parameters are derived from basic formulation. For numerical work, ABAQUS was used for the finite element analysis of the specimen. Strain hardening is modelled for typical hardening materials in addition to linear hardening used in theoretical work. Numerical results are compared with the theoretical investigations and results obtained for different cases of pressure sensitivity and strain hardening show that as the material strain hardening increases, J increases especially at low values of crack length. The effect of pressure sensitivity, on the other hand, tends to reduce J value.

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