

Extended Strain Energy Density Criterion for Fracture Investigation of Orthotropic Materials

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Abstract : In order to predict the fracture behavior of cracked orthotropic materials under mixed-mode loading, well-known minimum strain energy density (SED) criterion is extended. The crack is subjected along the fibers at plane strain conditions. Despite the complications to solve the nonlinear equations which are requirements of SED criterion, SED criterion for anisotropic materials is derived. In the present research, fracture limit curve of SED criterion is depicted by a numerical solution, hence the direction of crack growth is figured out by derived criterion, MSED. The validated MSED demonstrates the improvement in prediction of fracture behavior of the materials. Also, damaged factor that plays a crucial role in the fracture behavior of quasi-brittle materials is derived from this criterion and proved its dependency on mechanical properties and direction of crack growth.

Keywords : mixed-mode fracture, minimum strain energy density criterion, orthotropic materials, fracture limit curve, mode II critical stress intensity factor

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