Xiao, Q. Z.; **Karihaloo, B. L.**

FEM for evaluation of weight functions for SIF, COD and higher-order coefficients with application to a typical wedge splitting specimen. (English) Zbl 1187.74245

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Summary: In the evaluation of accurate weight functions for the coefficients of first few terms of the linear elastic crack tip fields and the crack opening displacement (COD) using the finite element method (FEM), singularities at the crack tip and the loading point need to be properly considered. The crack tip singularity can be well captured by a hybrid crack element (HCE), which directly predicts accurate coefficients of first few terms of the linear elastic crack tip fields. A penalty function technique is introduced to handle the point load. With the use of these methods numerical results of a typical wedge splitting (WS) specimen subjected to wedge forces at arbitrary locations on the crack faces are obtained. With the help of appropriate interpolation techniques, these results can be used as weight functions. The range of validity of the so-called Paris equation, which is widely used in the evaluation of the COD from the stress intensity factors (SIFs), is established.

MSC:

74S05 Finite element methods applied to problems in solid mechanics
74R10 Brittle fracture
74G70 Stress concentrations, singularities in solid mechanics

Keywords:

crack opening displacement (COD); finite element (FE); higher order term; hybrid crack element (HCE); Paris equation; stress intensity factor (SIF); weight function

Software:

Algorithm 697; Algorithm 760

Full Text: DOI