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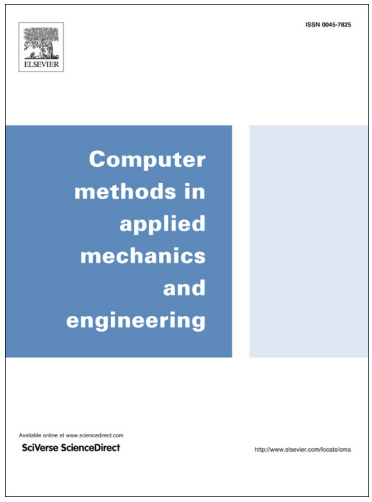

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Domain integral formulation for 3-D curved and non-planar cracks with the extended finite element method

Vicente F. González-Albuixech [a,1], Eugenio Giner [a], José E. Tarancón [a], F. Javier Fuenmayor [a], Anthony Gravouil [b]

[a] *Centro de Investigación de Tecnología de Vehículos - CITV*
Dpto. de Ingeniería Mecánica y de Materiales
Universitat Politècnica de València
Camino de Vera s/n, 46022 Valencia, Spain.
E-mail: vigonal@upvnet.upv.es

[b] *Laboratoire de Mécanique des Contacts et des Structures (LaMCoS)*
INSA-Lyon / UMR CNRS 5259
20 avenue Albert Einstein, F-69621 Villeurbanne, France

Abstract

The computation of stress intensity factors (SIF) in curved and non-planar cracks using domain integrals introduces some difficulties related to the use of curvilinear gradients. Several approaches exist in the literature that consider curvilinear corrections within a finite element framework, but these depend on each particular crack configuration and they are not general. In this work, we introduce the curvilinear gradient correction within the extended finite element method framework (XFEM), based only on the level set information used for the crack description and the local coordinate system definition. Our formulation depends only on the level sets coordinates and, therefore, an explicit analytical description of the crack is not needed. It is shown that this curvilinear correction improves the results and enables the study of generic cracks. In addition, we have introduced a simple error indicator for improving the SIF computed via the interaction integral, thanks to the better behaviour of the J-integral as it does not need auxiliary extraction fields.

Key words: XFEM, level sets, SIF, curved and non planar cracks, interaction integral, J-integral

[1] Currently at Laboratory for Nuclear Materials, Paul Scherrer Institut
5232 Villigen PSI, Switzerland
vicente.gonzalez@psi.ch

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