Asociación Argentina
de Mecánica Computacional

Mecánica Computacional Vol XXXV, págs. 2039-2039 (resumen)
Martín I. Idiart, Ana E. Scarabino y Mario A. Storti (Eds.)
La Plata, 7-10 Noviembre 2017

HIGH-FIDELITY SIMULATION OF BRITTLE FRACTURE PROBLEMS WITH UNIVERSAL MESHES

Adrián Lew

Department of Mechanical Engineering, Stanford University, Stanford, U.S.A.,
lewa@stanford.edu

Keywords: Free-boundary problems, thermal fracture, automatic meshing.

Abstract. We describe our approach to simulating curvilinear brittle fractures in two-dimensions based on the use of Universal Meshes. A Universal Mesh is one that can be used to mesh a class of geometries by slightly perturbing some nodes in the mesh, and hence the name universal. In this way, as the crack evolves, the Universal Mesh is always deformed so as to exactly mesh the crack surface. The advantages of such an approach are: (a) no elements are cut by the crack, (b) new meshes are automatically obtained as the crack evolves, (c) the crack faces are exactly meshed with a conforming mesh at all times, and the quality of the surface mesh is guaranteed to be good, and (d) apart from duplicating degrees of freedom when the crack grows, the connectivity of the mesh and the sparsity of the associated stiffness matrix remains unaltered. In addition to the mesh, we are now able to compute stress intensity factors with any order of convergence, which gives us unprecedented accuracy in computing the crack evolution. As a result, we observe first order convergence of the crack path as well as the tangent to the crack path in a number of different examples. In the presentation I will succinctly introduce the highlights of each one of the methods that together allow us to compute accurate crack paths, and then discuss their application to the simulation of thermally induced fracture. Different parts of this work are co-authored with Maurizio Chiaramonte (Princeton), Leon Keer (Northwestern University), Ramsharan Rangarajan (Indian Institute of Science, Bangalore).

Copyright © 2017 Asociación Argentina de Mecánica Computacional http://www.amcaonline.org.ar