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Cohesive Crack Propagation Modelling with Scaled Boundary Polygons Coupled with Interface Elements

***E. T. Ooi, M. Shi, C. Song and F. Tin-Loi**

[1]School of Civil and Environmental Engineering, University of New South Wales, Sydney, Australia

*Corresponding author: e.ooi@unsw.edu.au

Cohesive crack propagation is modelled using scaled boundary polygons coupled with interface elements. The bulk material is assumed to be linear elastic and modelled by the scaled boundary polygons. The interface elements model the fracture process zone between the crack faces. A shadow domain procedure couples the polygons and interface elements. The solution of the stresses in a cracked polygon is expressed semi-analytically as a power series and resembles an asymptotic expansion around a crack. Therefore, stress intensity factors can be evaluated directly from their definition. The zero-*K* condition, which determines the stability of a cohesive crack, can be accurately and conveniently evaluated without asymptotic enrichment or local mesh refinement. The direction of crack propagation is determined from linear elastic fracture mechanics criteria. A simple, yet flexible local remeshing algorithm for polygons is developed to propagate the cracks. The salient features of the method are demonstrated using two numerical benchmarks.

Keywords: fracture, cohesive crack, scaled boundary polygons, scaled boundary finite element method, crack propagation