

NEW CRACK-TIP ELEMENTS FOR XFEM AND APPLICATIONS TO COHESIVE CRACKS

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An extended finite element method scheme [1] for a static cohesive crack [2] is developed with a new formulation for elements containing crack tips. This method can treat arbitrary cracks independent of the mesh and crack growth without remeshing. All cracked elements are enriched by the sign function so that no blending of the local partition of unity is required. This method is able to treat the entire crack with only one type of enrichment function, including the elements containing the crack tip. This scheme is applied to linear 3-node triangular elements and quadratic 6-node triangular elements. To ensure smooth crack closing of the cohesive crack, the stress projection normal to the crack tip is imposed to be equal to the material strength. The equilibrium equation and the traction condition are solved by the Newton-Raphson method to obtain the nodal displacements and the external load simultaneously. The results obtained by the new extended finite element method are compared to reference solutions and show good agreement.

References

- [1] T. Belytschko, and T. Black, "Elastic crack growth in finite elements with minimal remeshing," *International Journal for Numerical Methods in Engineering*, v. 45, p. 601-620, 1999.
- [2] G. I. Barenblatt, "The mathematical theory of equilibrium of cracks in brittle fracture," *Advances in Applied Mechanics*, v. 7, p. 55-129, 1962.