

3D Dynamic Crack Simulation with Extended Finite Element Method

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ABSTRACT

The Extended finite element method (XFEM) is a special numerical method to handle arbitrary discontinuities in the displacement field independent of the finite element mesh. This is advantageous during crack initiation, growth and propagation processes. In the range of continuum damage mechanics, gradient-enhanced damage models [1] can be used to model damage and fracture without spurious mesh dependencies. Gradient-enhanced damage models have been investigated extensively in the context of quasi-brittle and elasto-plastic materials.

To avoid fracture and failure of metallic materials in industrial engineering, modelling the component under cyclic loading is significant for fatigue lifetime prediction [2]. Fatigue damage increases in a cumulative manner, along with a number of loading cycles, resulting in crack formation and fatigue failure of the component.

In this paper, a three-dimensional dynamic crack problem coupled with gradient-enhanced damage is studied on a mesoscale. The domain is discretized with 2nd-order ten-node tetrahedral elements. Discrete cracks are captured using the XFEM. The crack geometry is updated by level set methods. The focus of this contribution is set on algorithmic issues.

REFERENCES

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