Lattice model for failure based on embedded strong discontinuities in dynamic framework

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ABSTRACT

Identifying the failure of materials and structures is still a challenging task and there is no unique approach or model to tackle this problem. Complexities that arise in failure modelling are numerous, starting from mesh dependency for softening to various numerical difficulties and instabilities, tracking algorithms, multiple cracking with crack interactions etc. Failure in the dynamic framework is even more challenging bringing inertial effects, crack branching etc. In this paper, lattice model presented in [1-2] is enhanced to work in dynamics. The final goal is to simulate crack initiation and propagation in 2D brittle and quasi-brittle structures exposed to dynamic loads.

The strength of the lattice models is in their successful representation of failure mechanisms [3]. The presented model is based on a triangular lattice of Timoshenko beams which act as cohesive links between the Voronoi cells used to compute beam cross sections. The embedded strong discontinuities in axial and transversal beam directions serve for representation of failure mechanisms in modes I and II, while mass and inertial effects are included into lattice network.

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