Phase-field modeling of ductile fracture

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ABSTRACT

Phase-field modeling of *brittle* fracture [1-4] is a well-established framework that overcomes the limitations of the classical Griffith theory in the prediction of crack nucleation and in the identification of complicated crack paths including branching and merging. In this work, we propose a novel phase-field model for *ductile* fracture. The proposed formulation enables to capture the entire failure mechanism of a ductile material exhibiting J2-plasticity, encompassing crack initiation, propagation and failure. As illustrated in Figure 1 for the I-shaped specimen in tension, our model predicts the crack initiation in the center of a specimen, followed by the successive branching of the band, the bifurcation (loss of symmetry) and the final specimen failure. Beside the new formulation, several examples are discussed, including some with our own experimental verification.

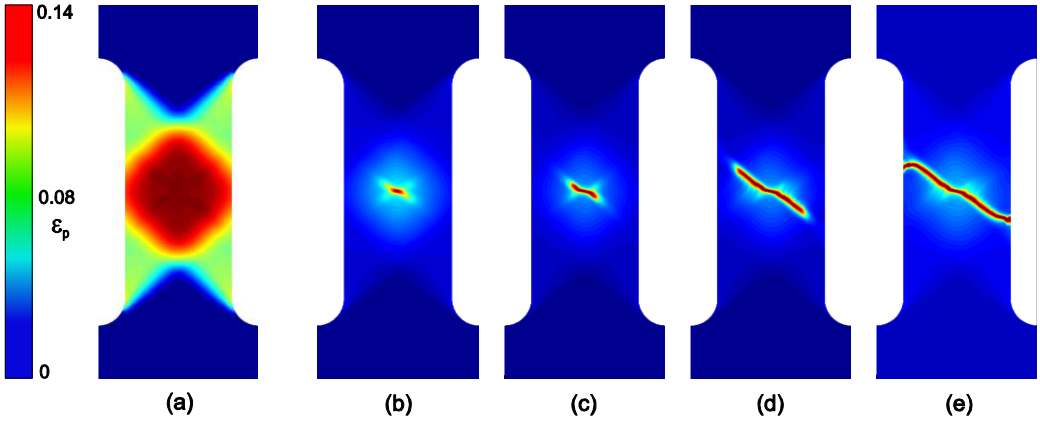

Figure 1. I-shaped specimen under tension: (a) Equivalent plastic strain at the initial stage and (b-d) crack phase-field at various fracture stages.

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