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Abstract

Anisotropy is inherent to crystalline materials (among others) due to the symmetry of the atomic lattice. However, failure anisotropy is questioning the foundations of brittle failure as the equivalence between the principle of local symmetry and the maximum energy release rate criterion is no longer valid. Many experimental observations have been reported in the literature but anisotropic failure is thus still an open path for fundamental research. The aim of the paper is to propose a phase field model that could reproduce (energetically) non-free anisotropic crack bifurcation within a framework allowing for robust and fast numerical simulations. After the model and its finite element implementation have been detailed, its ability to capture the thought phenomenon is illustrated through several examples.

Keywords: Crack propagation, Phase field, Anisotropy

1. Introduction

Anisotropy is inherent to crystalline materials (among others) due to the symmetry of the atomic lattice. Depending on the level of symmetry, one can derive the symmetry class for elasticity or other physical properties. Concerning failure, anisotropy is often higher than for elasticity for a given symmetry class. However, failure anisotropy is questioning the foundations of brittle failure as the equivalence between the principle of local symmetry and the maximum energy release rate criterion is no longer valid.

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