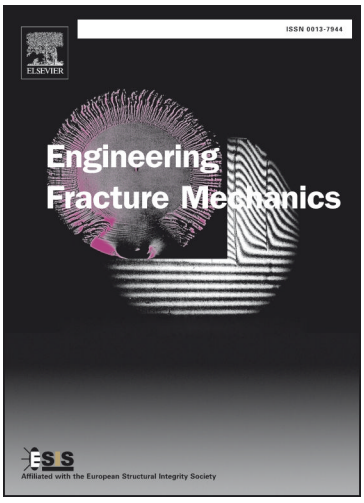

Fracture analysis of bulk superconductors under electromagnetic force

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Fracture analysis of bulk superconductors under electromagnetic force

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Abstract

Bulk high temperature superconductors exhibit priority magnetic properties compared to the conventional permanent magnets. Single grain bulk GdBaCuO superconductors have significant potential for application due to higher J_c and trapped fields. However, bulk is subjected to a larger Lorentz force in high magnetic field, and their performance is limited by the damage of materials. In this paper, a finite element model based on the H-formulation is used to solve the electromagnetic force in GdBCO bulk with defects or inclusions under the pulsed field. The strong local enhancement of electromagnetic force is observed at the crack tip. Then, a bond-based peridynamic (PD) approach is proposed for the dynamic mechanical behavior and brittle damage analysis of sample. The crack initiation and propagation path can be predicted with PD theory. It can be found that the PD is a suitable analysis method for the dynamic fracture problem. To further demonstrate the capabilities of the proposed model, the fracture process of bulk is simulated. The effects of void, cross cracks and multiple inclusions are presented. The results show that the mechanical stability can