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PROCEEDINGS

An Energy-Based Local-Nonlocal Coupling Scheme for Heterogeneous Material Brittle Fractures: Analysis and Simulations

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ABSTRACT

This study proposes a novel method for predicting the microcrack propagation in composites based on coupling the local and non-local micromechanics. The special feature of this method is that it can take full advantages of both the continuum micromechanics as a local model and peridynamic micromechanics as a non-local model to achieve composite fracture simulation with a higher level of accuracy and efficiency. Based on the energy equivalence, we first establish the equivalent continuum micromechanics model with equivalent stiffness operators through peridynamic micromechanics model. These two models are then coupled into a closed equation system, and a transition region is introduced to achieve a smooth transition between them. A composite strength-induced adaptive algorithm is introduced to solve the unified model. Numerical examples for particle reinforced composites are considered to show the accuracy and performance of the present method. The micromechanics-based coupling method has the potential to efficiently simulate the microcrack propagation in various complex composite materials.

KEYWORDS

Particle reinforced composites; micromechanics; microcrack propagation; peridynamic; adaptive coupling

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