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A Cosserat Bond-Based Correspondence Model

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ABSTRACT

In this study, we develop a Cosserat bond-based correspondence model (Cosserat BBCM) based on the bond-based correspondence model (BBCM) [1]. BBCM is a generalized bond-based peridynamic model, where the peridynamic pair-wise force (PD force) is calculated by classical constitutive equations through the relation between PD force and stress. In our previous study, we develop the Cosserat peridynamic model (CPM) to investigate the microstructure-related crack growth behavior [2, 3]. But the interactions between material particles are represented by PD forces and moments instead of the stress and couple stress. Due to this divergence, the Cosserat constitutive model such as the elastoplastic Cosserat model [4] is hard to be implemented into the CPM. To solve this problem, we try to introduce the Cosserat continuum into the BBCM and develop the Cosserat BBCM, where the PD forces and moments are calculated by Cosserat constitutive equations. In the numerical examples, the proposed Cosserat BBCM is validated through the comparison with the Cosserat finite element method. And the influences of microstructure parameters (internal length scale and Cosserat shear modulus) on the crack propagation are investigated.

KEYWORDS

Cosserat peridynamics; microstructure; numerical simulation; crack propagation

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