ICCES, 2024, vol.29, no.1
DOI: 10.32604/icces.2024.011454

PROCEEDINGS

A Phase Field Model for the Fracture of Micropolar Medium Considering the Tension-Torsion Coupling Effect

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ABSTRACT

A novel and irreversible phase field model accounting for tension-torsion coupling effect and size-effect is constructed in the context of continuum thermodynamics. First, a general framework considering the energy dissipation process influenced by micro and macro force is formulated according to thermodynamically consistent derivation. Next, the framework is specialized by introducing a material parameter called chiral coefficient to characterize the tension-torsion coupling effect within macro force constitutive according to isotropic micropolar elasticity theory. To gain insight of the chiral effect on the fracture behaviors, the analytical solution of uniaxial traction chiral rod is provided based on the proposed model. Besides, the proposed model is numerical implemented with finite element method and applied for exploring the fracture behaviors of chiral medium. The simulations demonstrate both the chiral coefficient and the bending characteristic length affect the damage profiles and global responses significantly, indicating the proposed method provide a proper way to identify such material parameters.

KEYWORDS

Phase field model; fracture; micropolar; chiral effect

Acknowledgement: The authors would like to thank the staff and postgraduate students at the fracture mechanics research group, HIT for their assistance in carrying out the study.

Funding Statement: This study was supported by the National Natural Science Foundation of China (NSFC) (Grant Nos. 12172103 and 12020101001) (https://www.nsfc.gov.cn) and Heilongjiang Touyan Innovation Team Program (https://www.hlj.gov.cn). The above grants are received by Hongjun Yu.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.