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A NEW SUPERPOSITION MODEL AND ITS APPLICATION ON INDENTATION CRYSTAL PLASTICITY

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Abstract

A new superposition model coupling 3D discrete dislocation dynamics (DDD) simulation with the finite element method (FEM) is proposed. In this method, the short-range interaction between dislocations can be described relatively accurate by handling the stress field around a dislocation line as a body force in a finite volume, so all the mechanical field with complex boundary can be calculated in FEM, while evolutions of the dislocation microstructure, i.e. the dislocation movement and morphological evolution, are calculated by the DDD code under the mechanical atmosphere transmitted from the FEM. With this, the whole mechanical field considering both influence of dislocations and complex boundary could be delineated in the FEM. Several simulation tests compared with the analytic solution are verified by this new superposition model, and then the indentation crystal plasticity is also investigated.

Keywords: *Dislocation dynamics; Superposition model; body force; indentation crystal plasticity; Dislocation theory; Discrete-Continuous Model*