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An Extended Finite Element Analysis on Evolution of Disclination Structure

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A disclinations is a line defect which can be regarded as a dense configuration of many dislocations. Because the wedge-shape discontinuity of disclination makes a high stress field, the disclination essentially has a high strain-energy. However some configuration, such as disclination dipoles, can reduce the strain energy, and this structure can be a promising model of description of grain boundary and other inelastic deformation. In this work, a theoretical method for modeling elastic field of disclinations is formulated. We use extended finite element method to simulate the model and analyze a boundary value problem disclinations are located in a finite elastic body. We will focus on the estimation of both strain energy and a generalized Peach-Koehler force of each disclination, and discuss the possibility of evolution of disclination structure.

Keywords: X-FEM, Disclination, Strain Energy, Peach-Koehler Force, PU