3-D Discrete Dislocation Dynamics Simulation Considering Boundary Effect Coupling With Finite Element Method

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Abstract

Metallic materials are widely used in various structures and very great important in the engineering materials. The plastic deformation of metallic materials is caused by the movement of discrete line defects which are called dislocations. Discrete Dislocation Dynamics (DDD) simulation [1] can handle the dislocations and the movement of dislocations in infinite space. However, only the periodic boundary conditions are considered in DDD simulation. In order to consider the actual boundary conditions, the continuum mechanics such as Finite Element Method (FEM) method is needed.

In this paper, we develop a three-dimensional (3-D) numerical model by coupling 3-D DDD and FEM to simulate the dislocation movement. The analysis is based on the superposition principle. We use the DDD code to compute the solution for dislocations in a nanoscale crystal. The external and internal boundaries are solved by parallel large-scale FEM code – ADVENTURE_Solid [2]. For the future work, practical problem of industry will be done.

Keywords: 3-D Discrete Dislocation Dynamics (3-D DDD) simulation, Finite Element Method (FEM), parallel large-scale simulation.

Acknowledgements

This research was supported by grants from the Project of the NARO Bio-oriented Technology Research Advancement Institution (R&D matching funds on the field for Knowledge Integration and innovation).

References

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