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应用数学联合研究中心
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MSU–BIT–SMBU Joint Research Center of Applied Mathematics

计算数学与控制系
Факультет вычислительной математики и кибернетики
Faculty of Computational Mathematics and Cybernetics

应用数学讲座

Научный Семинар по Прикладной Математике
Research Seminar on Applied Mathematics

应用数学报告（100）

报告人 / Докладчик / Speaker: Ilya Bryukhanov

题目 / Название / Title: Multiscale modelling of high strain rate deformation and shock compression of metal crystals

时间 / Время / Time：2024.7.04, 14:30-16:00

地点 / Место / Venue：主楼336

摘要 / Аннотация / Abstract:

The molecular dynamic simulations of shock-wave loading for copper and molybdenium crystals of micrometer length are performed in a wide range of temperatures and impact velocities. Crystal models with different initial distribution dislocations are considered: perfect crystals with no dislocations, crystals with dislocations in a selected region along the shock wave direction, and uniform distribution of dislocations across the crystal with different densities. The role of solutes in the case of Cu crystals is also studied. The time series of stress, particle velocities and temperature along the shock wave direction are obtained from the simulations. The features of the shock wave structure, such as the elastic precursor decay, the Hugoniot elastic limit and the rise time of the plastic wave, are discussed in the talk.

Based on the results of modeling by molecular dynamics methods, their use for the construction of a mesoscopic dislocation model of crystal plasticity is discussed. The application of continuum methods to describe the decay of elastic precursor of the shock wave in crystals of different orientations is discussed. The description of equations of state required for modeling impact compression using a neural network trained on molecular dynamic modeling of crystal compression along different deformation trajectories is given.

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个人简介：

Ilya Bryukhanov is a senior researcher in Institute of Mechanics Lomonosov Moscow State University, Moscow, Russia. Her research interest are multiscale simulation of materials. He completed his academic journey at the Faculty of Mathematics and Mechanics of Lomonosov Moscow State University, Moscow, Russia, earning his M.S. and Ph.D. degrees in 2011 and 2018, respectively. Since February 2012, he has been contributing as a researcher at the Institute of Mechanics Lomonosov Moscow State University, Moscow, Russia