

# The heterogeneous multiscale method for dynamics of solids with applications to brittle cracks

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**Abstract:** We present a multiscale method for the modeling of dynamics of crystalline solids. The method employs the continuum elastodynamics model to introduce loading conditions and capture elastic waves, and near isolated defects, molecular dynamics (MD) model is used to resolve the local structure at the atomic scale. The coupling of the two models is achieved based on the framework of the heterogeneous multiscale method (HMM) and a consistent coupling condition with special treatment of the MD boundary condition. Application to the dynamics of a brittle crack under various loading conditions is presented. Elastic waves are observed to pass through the interface from atomistic region to the continuum region and reversely. Thresholds of strength and duration of shock waves to launch the crack opening are quantitatively studied and related to the inertia effect of crack tips.