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Dual Domain Material Point Method for Materials in Extreme[1]

DUAN ZHANG, TILAK DHAKAL, Los Alamos National Laboratory — Dual domain material point method is the latest version of the material point method designed to overcome many numerical difficulties of the original material point method with an increased numerical accuracy. In this talk, after reviewing the numerical theory of the method, we apply this method to cases involving extreme material deformation, shock propagation, and pulverization based on continuum theories. We will compare this method to other similar particle methods, and then examine the applicability and needed modification of the continuum theory for cases involving strong thermodynamic non-equilibrium. The history of the material deformation is often important in such systems. We will explore the Lagrangian capability brought by the use of particles in the dual domain material point method and introduce a multiscale scheme taking advantages of the particle-mesh communications in the method to study history dependent thermodynamically non-equilibrium systems, caused by extreme material deformations, such as hypervelocity impact and shock loading. We will also discuss the history tracking capability, analyze numerical advantages and difficulties, and show the results obtained from this numerical scheme.

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