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Material Point Method and Multi-velocity Formulation for History Dependent Phase Transitions[1] DUAN ZHANG, XIA MA, Los Alamos National Laboratory — Phase transition has been used to describe both physical and chemical phenomena ranging from melting of ice, erosion of dirt and sand by storm water, combustion of fuel and pulverization of materials. Many of these processes involve effect of history. Tracing history in cases of extreme material deformation has been a significant issue for many numerical methods, especially in cases of phase transitions. The material point method (MPM) is a numerical method based on the wake solution principle of solving a set of partial differential equations. The starting point in this talk is a set of multi-velocity equations obtained based on statistical description of the materials. The equations and the numerical method allow for the use of realistic material models in cases of extreme deformation. The advantage of this statistical description is its convenience in the consideration of the transition between interacting continua to disperse debris flows. MPM uses Eulerian velocity field to describe the extreme material deformation, while uses Lagrangian material points to track material deformation history. We show comparisons of this multi-velocity formulation with traditional approaches and new capabilities of this formation and the numerical method.

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