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Scale-bridging schemes based on the material point method¹ SHAOLIN MAO, XIA MA, VIRGINIE DUPONT, DUAN ZHANG, Los Alamos National Laboratory — With recent development of heterogeneous computational resources, such as combined GPU and CPU computations, there is an emerging possibility to apply a continuum approach to thermodynamically non-equilibrium systems with the closure quantities, such pressure, computed directly from numerical simulation of systems at a smaller length and time scales. Although it may not be possible to calculate the entire physical system at the small length and time scales, one can calculate closure quantities at representative locations, such as Gauss points in a finite element calculation, or mesh nodes, cell centers in a finite volume calculation, by surrounding those points with small volumes, called sub-systems, and perform directly numerical simulation on them to consider physical interactions at the smaller time and length scales. Before this hopeful method can be practical, we need to study issues related history dependency, time interval and spatial size of the sub-systems to simulate in order to calculate the closure quantities with credible accuracy. We also need to study methods to communicate between the sub-systems. For this purpose, we develop a numerical scheme base on the material point method (MPM). Results from such studies and from the numerical scheme will be presented.

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