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Multiscale Modeling Facilitated by the Dual Domain Material Point Method[1] DUAN ZHANG, TILAK DHAKAL, Los Alamos National Laboratory — Many current multiscale methods are based on Eulerian descriptions, which have well-known difficulties when applied to problems of large material deformation and history dependency. Unfortunately, many problems requiring the consideration of multiscale and non-equilibrium thermodynamic effects are in this category. In this talk, a general multiscale approach is introduced to study material responses at different scales. The up-scaling approach uses the ensemble averaging technique. The required closures for the averaged equations are expressed in terms of lower scale quantities, which can be evaluated directly using numerical simulations following the motion of the material. The required history tracking can be achieved efficiently using the dual domain material point (DDMP) method because of the Lagrangian nature of the material points. The DDMP method requires only communications between material points and mesh nodes and no communication between material points. Therefore the response of the material represented by each material point can be numerically simulated independently in parallel computers with high efficiency. Applications of this approach to materials undergoing rapid and large deformation are demonstrated.

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