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Distribution Coefficient Algorithm for Small Mass Nodes in Material Point Method for Multi-Phase Flow XIA MA, BALAJI JAYARAMAN, PAUL GIGUERE, DUAN ZHANG, Los Alamos National Laboratory — One of the advantages of the Material Point Method (MPM) is its capability to simulate large material deformation and flows without the need to advect state variables, such as stress and strain of the material through an Eulerian mesh. Without numerical diffusion associated with such advection, MPM can keep sharp interface without smearing them. MPM also avoids distortion and entanglement of meshes associated with Lagrange methods in the case of a large deformation. However, the straightforward MPM has its own disadvantages. When a material just enters a new cell, it can cause a very small mass on the nodes near the material boundary. As the denominator in the calculation of the acceleration, this small mass can cause numerical instability and leads to artificially large acceleration. The present work deals with this numerical instability by transferring the force away from the small mass nodes in a manner consistent with the errors of the original MPM calculation. This treatment significantly improves the stability of multi-phase flow simulation using MPM. The numerical cost of this algorithm is negligible considering the computational time saved by the significantly increased time step size. We provide comparisons between the results calculated with and without this improvement to MPM. Release number: LA-UR 10-05193.

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