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A More Effective Method for DNS of Deformable Solid Particles and Fibers with Sharp Fluid-Solid Boundary JINGSHU WU, CYRUS AIDUN, Georgia Institute of Technology — We have developed a new method for coupling the lattice-Boltzmann (LB) equations in the fluid phase with the lattice-Spring (LS) discretization of the deformable solid phase which we refer to as the 'Immersed Grid' (IG) method. This approach allows direct numerical simulation of large number of deformable particles and fibers suspended in fluid. The LB equation for the fluid is solved on a fixed regular lattice where the deformable suspended particles are fit into a Lagrangian grid with sharp fluid-solid boundary. The fluid-solid interactions are enforced by the IG method where the fluid velocity field is solved by adding the force density term into the LB analysis as the particle movement is captured from the Newtonian dynamics equations. The LS method is applied to calculate the solid particle deformation. Compared to the regular "bounce-back" method for LB-LS coupling, we will show that this method is more stable and smooth. In the regular "bounce-back" method, the fluid-solid boundaries are approximated at the midpoints on the fluid grid, with sudden jump from node to node causing small fluctuations on the interaction forces. Compared to Immersed Boundary method, which uses artificial penalty parameters to simulate stiff particles, the new method can handle large deformations. The methodology is validated by comparing to experimental and analytical results.

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