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An Immersed Boundary-Lattice Boltzmann Method for Simulating Particulate Flows BAILI ZHANG, MING CHENG, JING LOU, Institute of High Performance Computing — A two-dimensional momentum exchange-based immersed boundary-lattice Boltzmann method developed by X.D. Niu et al (2006) has been extended in three-dimensions for solving fluid-particles interaction problems. This method combines the most desirable features of the lattice Boltzmann method and the immersed boundary method by using a regular Eulerian mesh for the flow domain and a Lagrangian mesh for the moving particles in the flow field. The non-slip boundary conditions for the fluid and the particles are enforced by adding a force density term into the lattice Boltzmann equation, and the forcing term is simply calculated by the momentum exchange of the boundary particle density distribution functions, which are interpolated by the Lagrangian polynomials from the underlying Eulerian mesh. This method preserves the advantages of lattice Boltzmann method in tracking a group of particles and, at the same time, provides an alternative approach to treat solid-fluid boundary conditions. Numerical validations show that the present method is very accurate and efficient. The present method will be further developed to simulate more complex problems with particle deformation, particle-bubble and particle-droplet interactions.

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