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Simulation of turbulent flow laden with finite-size spherical particles HUI GAO, LIAN-PING WANG, University of Delaware — Particle-laden turbulent flow is of importance to many engineering applications and natural phenomena. Most previous studies utilize the point particle approach to study the effects of particles on the carrier turbulence, under the assumptions that the particle size is significantly smaller than the smallest turbulence length scale and the particle volume fraction is low. The present study focuses on the motion and hydrodynamic interactions of finite-size freely moving particles in a turbulent background flow. A mesoscopic lattice Boltzmann approach is applied to simulate a homogeneous isotropic turbulence and to realize the no-slip boundary condition on the boundary of each moving particle. The short-range lubrication force not resolved by the simulation is represented by a model in terms of particle relative location and velocity. The change of energy spectrum compared with the particle-free turbulence is discussed, as well as the time evolution of the turbulent kinetic energy and the dissipation rate. The effects of varying particle size, volume fraction, and particle-to-fluid density ratio will also be examined.

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