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Comparing particle-resolved simulation methods for moving particles in a viscous fluid LIAN-PING WANG, HUI GAO, U. Delaware, LI-SHI LUO, YAN PENG, Old Dominion U., KYONG MIN YEO, MARTIN R. MAXEY, Brown U. — In recent years, quite a few particle-resolved simulation methods have emerged for treating moving solid particles in a viscous fluid. A common advantageous feature shared by these methods is the use of a simple fixed mesh. The no-slip boundary condition on the surface of a particle is handled locally by a consistent coupling or interaction scheme. Here we examine four such methods: lattice Boltzmann equation (LBE) with interpolated bounce back scheme, LBE with immersed boundary method, a hybrid method (Physalis) developed by Prosperetti and co-workers, and a force-coupling method. Our main objective is to inter-compare these methods in terms of accuracy of the simulated flow field, force / torque, and computational efficiency. Two benchmark cases are used: a particle moving in a 3D Couette flow and a 3D flow induced by a spinning sphere at finite Reynolds number. The results are discussed in terms of flow Reynolds number and geometric parameters. We will also comment on the range of relevant physical parameters accessible in these methods.

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