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Direct Numerical Simulations of Solid-Fluid Flows Using a Variant of immersed boundary method in Gerris PEI SHUI, PRASHANT VALLURI, University of Edinburgh, UK, STÉPHANE POPINET, National Institute of Water and Atmospheric research, New Zealand — A novel 3D Immersed Boundary Method simulating fully coupled fluid-solid interaction with 6 degrees-of-freedom (6DOF) movement has been developed under the aegis of the GERRIS code. Any number of fully immersed solids with complex shapes can be considered. A repulsive force which is the sum of all short-range interactions accounts for collisions and ensures that the solids and the wall do not intersect. The solid-fluid solver has been validated against a series of benchmark cases at a wide range of solid Reynolds numbers (0.1 1000) including that of Jeffrey's orbits. In addition, strong hydrodynamic interaction is seen between multiple solids placed in shear flow. The interaction force is being calibrated as a function of relative distance between the solids, drag and lift forces and will be presented in the conference. In the inertial regime, the problem of migrating dense spheres under Poiseuille flow has been quantitatively validated against simulation results and experiments of Yu et al (2004). There are however some minor divergences in results for migration of neutrally buoyant spheres, but are in full quantitative agreement with experiments of Jeffrey (1989).

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