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Direct Numerical Simulation of Poly-dispersed Solid-Fluid Systems ERICH ESSMANN, PEI SHUI, University of Edinburgh, RAMA GOVINDARAJAN, TIFR-Hyderabad, STEPHANE POPINET, Universit Pierre et Marie Curie, PRASHANT VALLURI, University of Edinburgh — The fluid dynamics of poly-dispersed solid – fluid systems are of great importance, particularly is the behaviour of methane clathrates slurries. In this work, a framework is being developed for the direct numerical simulation of these systems. We have extended the Gerris software package of (Popinet et al, 2003). In our solid solver, Gerris Immersed Solid Solver (GISS), to account for collisions we have implemented a novel contact model (Ness & Sun, 2016) for solid-solid interactions. A composite contact model is being used, in which each solid in the domain is divided into two regions. The outer region uses a Hookean repulsive and a lubrication force model to simulate contact. The inner region uses a constraint based contact model to ensure that the numerical overlap of the solids is not excessive. We have validated our methodology against published experimental data. Particularly, we compared the chaotic motion of an ellipsoidal solid in an ideal fluid (Aref, 1993) to that predicted by GISS and the settling behaviour of two colliding spheres of different densities (Zhao, 2003). The validated extensions will allow us to compare previous results from GISS to regimes in which solid-solid contact is important.

Erich Essmann
University of Edinburgh

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