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Immersed boundary methods for viscoelastic particulate flows
SREENATH KRISHNAN, ERIC SHAQFEH, GIANLUCA IACCARINO, Stanford Univ — Viscoelastic particulate suspensions play key roles in many energy applications. Our goal is to develop a simulation-based tool for engineering such suspensions. This study is concerned with fully resolved simulations, wherein all flow scales associated with the particle motion are resolved. The present effort is based on Immersed Boundary methods, in which the domain grids do not conform to particle geometry. In this approach, the conservation of momentum equations, which include both Newtonian and non-Newtonian stresses, are solved over the entire domain including the region occupied by the particles. The particles are defined on a separate Lagrangian mesh that is free to move over an underlying Eulerian grid. The development of an immersed boundary forcing technique for moving bodies within an unstructured-mesh, massively parallel, non-Newtonian flow solver is thus developed and described. The presentation will focus on the numerical algorithm and measures taken to enable efficient parallelization and transfer of information between the underlying fluid grid and the particle mesh. Several validation test cases will be presented including sedimentation under orthogonal shear a key flow in drilling muds and fracking fluids.

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