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Immersed boundary methods for particles in viscoelastic drilling muds SREENATH KRISHNAN, ERIC SHAQFEH, GIANLUCA IACCARINO, Stanford Univ — In fracture stimulation of oil and gas wells, polymeric solution with suspended solids (proppants) are pumped to prop open the fracture. The primary aim of our work is to understand the dynamics of such proppants under various flow conditions through numerical computations. The study is concerned with fully resolved simulations, wherein all scales associated with the particle motion and the flow are resolved. The present effort is based on the algorithm proposed by Patankar (CTR Annual Research Briefs 2001:185-196), i.e. the Immersed Boundary (IB) methods, in which the domain grids do not conform to particle geometry and for simplicity are chosen to be Cartesian. Since Cartesian grids cannot efficiently represent a fracture geometry, our focus is on the development of an IB method for viscoelastic flows in unstructured domain grids. This method is implemented in a massively parallel, unstructured finite-volume-based fluid solver developed at Stanford University. The main theme of the presentation will be the description of the algorithm, measures taken to enable efficient parallelization and transfer of information between the underlying fluid grid and the particle mesh. A number of flow simulations will be presented, which validates the accuracy and correctness of the algorithm.

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