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Rheological properties of flexible fiber suspensions in the presence of spherical bodies VAHID TAVANASHAD, KOUROSH SHOELE, Florida State University — Hydrodynamic interaction between flexible fibers and surrounding fluid and fibers interaction with other immersed objects is a key problem in many environmental and industrial applications. In this work, we represent the fibers by a discrete set of points forming a curve (one-dimensional bodies) and use the immersed boundary method to simulate the fluid-structure interaction. We first present the results from the simulation of suspensions of flexible fibers in a cubic domain. It is discussed that the presence of fibers modifies the rheological properties (viscosity) of the suspension. Then we assume different fractions of immersed bodies are three-dimensional spherical objects and investigate how the behavior of suspended immersed bodies is modified with the ratio of fibers to spherical bodies. Since the drag force on the immersed object is a function of the viscosity of the surrounding fluid/suspension, the presence of flexible fibers and their interaction with other suspended objects affects the clustering properties of the assembly and ensemble properties of the system. Finally, a stress closure model is proposed using the homogenization technique to account for the rheological behavior changes with the fiber-to-sphere ratio.

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