Rheology of dense fiber suspensions: Origin of yield stress, shear thinning, and normal stress differences

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We use high-fidelity computational model of fiber suspension to investigate suspension rheology. We investigate the interplay between the hydrodynamic, noncontact attractive and repulsive, and interfiber contact interactions. The shear-thinning viscosity and finite yield stress obtained from the Immerse Boundary Method simulations align quantitatively with experimental findings from the literature. The study demonstrates that attractive interactions lead to both yield stress and shear thinning behavior in rigid fiber suspensions. This discovery holds significance as it contributes to the ongoing debate on the source of yield stress in fiber suspensions. The proposed model is used to quantify normal stresses in addition to shear thinning and yield stress.