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Particle migration of colloidal and Brownian suspensions in both Poiseuille and circular Couette flow[1] CHANGWOO KANG, PARISA MIRBOD, University of Illinois at Chicago — The flow of neutrally buoyant and hard-sphere colloidal particles concentrated in a Newtonian viscous fluid is examined by direct numerical simulations (DNS) at various bulk particle volume fraction ($0.1 \leq \phi_b \leq 0.5$) and Peclet number ($10^{-2} \leq Pe \leq 10^3$). We use the diffusive flux model (DFM) to describe the behavior of suspensions and employ the viscosity introduced by de Kruif et al. [J. Chem. Phys. 1985] which is given as a function of shear rate and volume fraction. First, we consider pressure-driven flow of colloidal particles in a channel. For low Pe number the concentration profile flattens, as Pe grows the influence of Brownian motion diminishes and the distribution of concentration reaches the profile of non-colloidal suspensions flow. Also, as Brownian motion becomes dominant, the volume flow rate decreases steadily. We then study a circular Couette flow of colloidal suspensions where the inner cylinder rotates with a constant angular velocity and the outer one is fixed. The concentration profile flattens out and the local shear rate decays with the reduction of Pe number. The torque acting on the inner cylinder builds up due to colloidal suspensions.

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