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Particle self-diffusion in a viscous shear flow: from hydrodynamic interactions to collisional effects MICHELINE ABBAS, Twente University, ERIC CLIMENT, OLIVIER SIMONIN, Institut National Polytechnique de Toulouse, MARTIN MAXEY, Brown University — Particle shear-induced self-diffusion is investigated at low Reynolds and variable Stokes St numbers. We simulated the suspension hydrodynamics for $St << 1$ by using the Force Coupling Method. For suspensions with finite particle inertia (finite St), we proposed a new Eulerian prediction based on the kinetic theory for granular flows which has been validated by discrete particle simulations assuming Stokes drag and binary collisions (for low to moderate solid concentration). On the microscopic level, the particle velocity fluctuations have a Gaussian distribution shape for both high and vanishing St, whereas they show a highly peaked distribution for suspensions characterized by St $O(1)$ and low solid volume fractions. On the macroscopic level, the self-diffusion tensor is strongly anisotropic and the diffusive behavior becomes more prominent when the particle inertia increases. The self-diffusion coefficients decrease with concentration at high St. The results will be analyzed in terms of analogies and differences between the two regimes investigated (hydrodynamic interactions or collisional effects).

Micheline Abbas
Twente University

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