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Flow of a suspension over an obstacle: revisiting an old problem in a new context JEFFREY MORRIS, Levich Institute of City College of New York, HAMED HADDADI, University of California Los Angeles, SHAHAB SHOJAEI-ZADEH, Rutgers University, KEVIN CONNINGTON, Stevens Institute of Technology — The flow of a fluid over an obstacle, with the associated separation of streamlines and recirculating wake, is a classical fluid mechanical phenomena that has been instrumental in development of our understanding of the interaction of viscous and inertial effects in simple fluids. Visualizations of these behaviors serve as benchmark observations. However, replacing the pure fluid with even a simple multiphase material, a suspension immersed in a Newtonian fluid, poses new questions in understanding the physics in these phenomena. In experimental observation of a dilute suspension flow over bluff bodies in a microfluidic device, we have observed formation of a depleted zone in the recirculating wake region. Using numerical simulations, it has been deduced that rigid spherical particles with finite size released inside the wake region migrate towards the wake boundaries, forming a limit cycle. The tendency of particles to outward motion leads to formation of the depleted region. In the present work, we probe the limit cycle phenomena and other aspects of the suspension flow over obstacles, such as average particle velocities and velocity fluctuations and force on the obstacle using detailed lattice-Boltzmann simulations and microfluidic experiments.

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