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Effect of Inertia on the Hydrodynamic Interaction between Two Liquid Capsules in Shear Flow SAI DODDI, PROSENJIT BAGCHI, Rutgers University — Three-dimensional numerical simulations using front-tracking method are performed to study the hydrodynamic interaction between two liquid capsules suspended in simple shear flow in presence of inertia. Capsules are modeled as liquid drops surrounded by elastic membranes. In the limit of zero inertia, it is known that the hydrodynamic interaction between two deformable particles (drops/capsules) in shear flow results in an irreversible shift in the trajectories of the particles leading to shear-induced diffusion. Here we show that the presence of inertia can significantly alter capsule trajectories. When inertia is small but finite, capsules do undergo shear-induced diffusion, but the lateral separation between them first decreases before they roll over each other. For moderate to high inertia, capsules reverse their directions of motion before coming close to each other. The reversal of motion occurs progressively earlier in time with increasing inertia. The long-time behavior of the capsule-capsule interaction at finite inertia shows that the capsules engage in spiraling motions. The reversal of motion, and the spiraling trajectories at finite inertia have no analogy in the limit of zero inertia. Such motions are explained by analyzing the flow field around a deformed capsule which shows reverse flow regions and off-surface stagnation points, similar to those previously reported in case of rigid spheres and cylinders under torque-free condition.

Prosenjit Bagchi
Rutgers University

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