Sphere interaction in bounded shear flow of Oldroyd-B fluids

SHANG-HUAN CHIU, TSORNG-WHAY PAN, ROLAND GLOWINSKI, Dept of Mathematics, Univ of Houston — It is well-known that, up to the initial sphere displacement, binary encounters of spheres in bounded shear flow of a Newtonian fluid can have either swapping or non-swapping trajectories under creeping flow conditions (Zurita-gotor et al., J. Fluid Mech. 592 (2007) 447-469). The motion of dilute sphere suspensions in bounded shear flow of Oldroyd-B fluids at zero Reynolds number has been studied. The pass and return trajectories of the two ball mass centers in a two wall driven shear flow are similar to those in a Newtonian fluid; but they lose the symmetry due to the effect of elastic force arising from viscoelastic fluids. A tumbling chain of two balls (a dipole) may occur, depending on the value of the Weissenberg number and the initial vertical displacement of the ball mass center to the middle plane between two walls. The two ball tumbling motion has also been compared with that of an ellipsoid in bounded shear flow Oldroyd-B fluids.

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