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Deformation of Elastic Particles in Viscous Shear Flow TONG GAO, HOWARD HU, University of Pennsylvania — The dynamics of two dimensional elastic particles in a Newtonian viscous shear flow is studied numerically. A constitutive equation is constructed for an incompressible "Neo-Hookean" elastic solid where the extra stress tensor is assumed to be linearly proportional to the Almansi strain tensor. A monolithic finite element solver which uses Arbitrary Lagrangian-Eulerian moving mesh technique is then implemented to solve the velocity, pressure and stress in both fluid and solid phase simultaneously. It is found that the deformation of the particle in the shear flow is governed the Reynolds number (Re) and the Capillary number (Ca). In the Stokes flow regime, the particle deforms into an ellipse while the material points inside experience a tank- treading like motion, and the deformation of the elastic particle is observed to vary linearly with Ca. Interactions between two particles in a viscous shear flow show that after the initial complicated interactions, both particles reach an equilibrium elliptic shape which is consistent with that of a single particle. Both rigid body rotation and buckling motion are observed when an elastic long particle is suspended in a shear flow.

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