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A new method for calculation of acting forces on a deformable droplet in shear flow[1] YOUNGHO SUH, CHANGHOON LEE, Yonsei University — A numerical method for calculating drag and lift acting on a deformable droplet in linear shear flow is presented. In this study, a level set approach is adopted to handle deformation and break-off of the interfaces. In order to determine the acting force on a droplet in shear flow field, we adopt feedback forces which can maintain the droplet at a fixed position with efficient handling of deformation. The presented method is applied for numerical simulation of spherical, deformed, and oscillating droplets in uniform flow, and the numerical results are favorably compared with the data reported in the literature [Dandy and Leal, JFM (1989)], [Feng and Beard, J. Atmos. Sci. (1991)]. The computation demonstrates that the shape of droplet deforms from sphere to oblate ellipsoid by increasing the Reynolds and Weber numbers. For large inertial effects at high Reynolds number, the droplet eventually breaks up into smaller droplets. Based on the numerical results, drag and lift forces acting on a droplet are observed to strongly depend on the deformation. Also, the present method is proven to be applicable to a three- dimensional deformation of droplet in the shear flow, which cannot be properly analyzed by the previous studies.

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