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Effect of ambient flow inhomogeneity on shear-induced lift on a sphere at finite Reynolds number JUNGWOO KIM, Seoul National University of Science and Technology — In particle-laden flows involving particle transport and dispersion, the prediction capability of hydrodynamic forces on the particle in a non-uniform flow is one of the central issues. However, existing analytical expressions and empirical correlations are mainly based on uniform or other simple linear ambient flows such as uniform shear and uniform vortex. Therefore, the objective of this study is to investigate the effect of flow inhomogeneity on shear-induced lift on a sphere. To do so, we perform direct numerical simulations of a sphere in an inhomogeneous shear. One of the inhomogeneous shear flows considered is the sine profile having the form of $u(x,y)/U_\infty = 1 + K\sin(2\pi\frac{y/D}{L/D})$. Here, U_∞ is the fluid velocity at the center of the sphere, D the sphere diameter, L the period of the sine profile. Also, the Reynolds number is $\frac{U_\infty D}{\nu} = 100$. The present simulations show that the lift forces are decreased with increasing the degree of the flow inhomogeneity (that is, D/L) while the non-dimensional shear rate at the location of sphere center is fixed to be $2\pi\frac{K}{L} = 0.1$. Comparing the change in the lift force with respect to surface-averaged vorticity under uniform inlet shear, that under inhomogeneous shear has certain systematic deviations. In the final presentation, more details of the shear-induced lift on a sphere in inhomogeneous shear flows considered would be presented.

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