Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Effect of ambient flow inhomogeneity on drag forces on a sphere at finite Reynolds numbers JUNGWOO KIM, Seoul National University of Science and Technology, S. BALACHANDAR, University of Florida, HYUNGOO LEE, Korea Atomic Energy Research Institute — For studies on 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 made based on the homogeneous flow conditions such as uniform or uniform shear flows. Therefore, the objective of this study is to investigate the effect of flow inhomogeneity on drag forces on a sphere at finite Reynolds numbers. To do so, we perform direct numerical simulations of flow over a sphere in an inhomogeneous flow. In this study, we consider three different kinds of the inhomogeneous flows: cosine, hyperbolic cosine and hyperbolic secant profiles. The Reynolds number of the sphere based on the freestream velocity and sphere diameter is 100. The present simulations show that the quasi-steady drag forces in inhomogeneous flows are reasonably estimated by standard drag law based on the relative velocity if the fluid velocity seen by the particle is evaluated by surface average. The results support Loth and Dorgan (2009)'s proposed formula. In the final presentation, the effect of ambient flow inhomogeneity on drag forces would be presented in more detail.

Jungwoo Kim
Seoul National University of Science and Technology

Date submitted: 01 Aug 2013 Electronic form version 1.4