Abstract Submitted
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A Physics/Data-Driven Comprehensive Multiphase Force Coupling Model That Systematically Accounts For Clustering & Shear Effects.[1] GEORGES AKIKI, Notre Dame University-Louaize, DUAN ZHANG, Los Alamos National Lab, S BALACHANDAR, University of Florida — Traditional approach to modeling the phase interaction has been through drag and lift force models that depend on Re and volume fraction θ. However, it has been recognized that it is important to take into account local volume fraction gradients in particle distribution. Recently, it has been shown that the Particle-Fluid-Particle (PFP) stress can be rigorously defined, whose divergence accounts for the effect of inhomogeneous particle distribution. A series of fully-resolved DNS of flow around a uniform random distribution of particles are performed from which the PFP stress was evaluated. We then show how the DNS results can be accurately recovered with the pairwise interaction extended point-particle (PIEP) model. This allows the evaluation of the PFP stress for a wide range of Re and θ at a negligible computational cost. We then test the PFP force in inhomogeneous distributions of particles by comparing the model prediction against results obtained from DNS. We also performed DNS of shear flow through a uniform random distribution of particles to establish the shear-induced lift force model at finite θ. The significance of these new forces are then analyzed and compared to the mean streamwise force in uniform flows and to the mean streamwise and lateral forces in shear flows.

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