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Accurate modeling of group settling of a dense cluster of particles using the corrected-point-particle (cPP) approach[1] LOKESH JOTHI VINCENT, PEDRAM PAKSERESHT, SOURABH V. APTE, Oregon State University
— Modeling dense clusters of slightly-heavier-than-fluid particles using a two-way coupled Euler-Lagrange approach requires accurate estimation of the fluid forces acting on the particles. Typical force closures require the undisturbed fluid velocity at the particles' location, which is not readily available in the two-way coupled simulations. In this work, a correction scheme developed by Pakseresht et al (JCP, 2020) is employed to recover the undisturbed fluid velocity from the available disturbed field. Fluid forces including drag, lift, added mass, and pressure gradient are employed to track particles. In addition, the history force, commonly neglected due to its expensive computation, is computed using a reduced-order model developed by Hinsberg et al (JCP, 2011). The present approach is tested for predicting the settling velocity of a single particle as well as a cloud of particles in a quiescent fluid. Different test cases are performed to cover a range of particle loading, various particle Reynolds numbers, different particle Stokes numbers, and different particle-to-grid size ratios. Results with and without the correction scheme are compared against available experimental data and the importance of the Basset history force is quantified for the studied cases.

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