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Correcting velocity and volume-fraction calculations in two-way-coupled, particle-laden-flow simulations PETER IRELAND, Cornell University, JESSE CAPECELATRO, University of Illinois Urbana-Champaign, RODNEY FOX, Iowa State University, OLIVIER DESJARDINS, Cornell University — In many flows, the motion of the carrier phase is altered by the presence of inertial particles. To alleviate the computational demands associated with resolving the boundary layers around these particles, volume-filtering is often applied to the underlying flow field, and model equations are solved for the forces on the particles. These model equations involve terms which depend on the fluid properties at the particle center in the absence of the disturbance induced by the particle (i.e., the 'undisturbed fluid properties'). In a two-way-coupled simulation, however, we generally only have access to fluid properties after the particle-induced disturbance (i.e., the 'disturbed fluid properties'). Using the disturbed fluid properties in the particle model equations leads to an under-prediction of the drag on the particles and an over-prediction of the particle settling velocity. We introduce analytical corrections to alleviate this issue for low particle Reynolds numbers, allowing us to recover undisturbed fluid properties from the disturbed fluid field, and thereby providing more accurate calculations of the particle velocity and drag. We show comparisons between the results with and without the corrections in both uniform Stokes flows and cluster-induced turbulent flows.

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