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Direct Numerical Simulation of dense particle-laden turbulent flows using immersed boundaries FAN WANG, OLIVIER DESJARDINS, Univ. of Colorado at Boulder — Dense particle-laden turbulent flows play an important role in many engineering applications, ranging from pharmaceutical coating and chemical synthesis to fluidized bed reactors. Because of the complexity of the physics involved in these flows, current computational models for gas-particle processes, such as drag and heat transfer, rely on empirical correlations and have been shown to lack accuracy. In this work, direct numerical simulations (DNS) of dense particle-laden flows are conducted, using immersed boundaries (IB) to resolve the flow around each particle. First, the accuracy of the proposed approach is tested on a range of 2D and 3D flows at various Reynolds numbers, and resolution requirements are discussed. Then, various particle arrangements and number densities are simulated, the impact on particle wake interaction is assessed, and existing drag models are evaluated in the case of fixed particles. In addition, the impact of the particles on turbulence dissipation is investigated. Finally, a strategy for handling moving and colliding particles is discussed.

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