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A Comparative Study of Euler-Euler and Euler-Lagrange Mesoscale Simulations of Moderately Dense Cluster-induced Gas-Particle Turbulence BO KONG, Ames Laboratory - USDOE, Iowa State Univ., RAVI PATEL, Cornell University, JESSE CAPECELATRO, University of Michigan, OLIVIER DESJARDINS, Cornell University, RODNEY FOX, Iowa State University
— Recently Euler-Lagrange (EL) approaches have gained considerable popularity, but the computational cost of resolved EL simulations is often prohibitively high. Therefore, Euler-Euler (EE) approaches, such as kinetic-theory-based two-fluid models (TFM), remain the major workhorse in this area. However, the hydrodynamic assumption in TFM has been proven invalid by many experiments and simulations, especially for dilute particles. Previously, the EE Anisotropic Gaussian approach (EE-AG) has been shown to produce good agreement for key statistic results with EL simulations when particles are dilute. In this work, a novel EE-AG/TFM hybrid solution algorithm, based on different contributions to the particle-phase spatial fluxes, is proposed and implemented in an open-source CFD package. Fully resolved mesoscale simulations of cluster-induced turbulence with moderately dense particles are performed. The detailed comparisons with EL simulations demonstrate that this new EE method can accurately capture the dynamics of the gas-solid flows and produce results comparable to the EL simulations.

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