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A Hybrid Physics-Based Data-Driven Approach for Point-Particle Force Modeling[1] CHANDLER MOORE, Center for Compressible Multiphase Turbulence, University of Florida, GEORGES AKIKI, Los Alamos National Laboratory, S. BALACHANDAR, Center for Compressible Multiphase Turbulence, University of Florida — This study improves upon the physics-based pairwise interaction extended point-particle (PIEP) model. The PIEP model leverages a physical framework to predict fluid mediated interactions between solid particles. While the PIEP model is a powerful tool, its pairwise assumption leads to increased error in flows with high particle volume fractions. To reduce this error, a regression algorithm is used to model the differences between the current PIEP model's predictions and the results of direct numerical simulations (DNS) for an array of monodisperse solid particles subjected to various flow conditions. The resulting statistical model and the physical PIEP model are superimposed to construct a hybrid, physics-based data-driven PIEP model. It must be noted that the performance of a pure data-driven approach without the model-form provided by the physical PIEP model is substantially inferior. The hybrid model's predictive capabilities are analyzed using more DNS. In every case tested, the hybrid PIEP model's prediction are more accurate than those of physical PIEP model.

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