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A direct comparison of fully resolved and point-particle models in particle-laden turbulent flow[1] JEREMY HORWITZ, Stanford University, MOHAMMAD MEHRABADI, University of Illinois at Urbana-Champaign, SHANKAR SUBRAMANIAM, Iowa State University, ALI MANI, Stanford University — Point-particle methods have become a popular methodology to simulate viscous fluids laden with dispersed solid elements. Such methods may be contrasted with particle-resolved methods, whereby the boundary conditions between particles and fluid are treated exactly, while point-particle methods do not capture the boundary conditions exactly and couple the continuous and dispersed phase via point-forces. This allows point-particle methods to simulate particle-turbulence interaction at considerably lower resolution and computational cost than particle-resolved methods. However, lack of validation of point-particle methods begs the question of the predictive power of point-particle methods. In other words, can point-particle methods recover particle and fluid statistics compared with particle-resolved simulation of dynamically equivalent non-dimensional problems? We address this question in this work by examining decaying homogeneous isotropic turbulence laden with particles. For the same nominal conditions, we compare statistics predicted by a particle resolved method to those predicted by a point-particle method. We also examine the effect of the undisturbed velocity in the point-particle drag law by studying the same problem with a correction scheme.

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