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Numerical simulation of two-way coupling mechanism in particle-laden turbulent flow based on one-dimensional turbulence model GUANGYUAN SUN, DAVID LIGNELL, Brigham Young University, JOHN HEWSON, CRAIG GIN, Sandia National Laboratories — We present three algorithms (type-I, type-C and type-IC) for Lagrangian particle transport within the context of the one-dimensional turbulence (ODT) approach. ODT is a stochastic model that captures the full range of length and time scales and provides statistical information on fine-scale turbulent-particle mixing and transport at low computational cost. Two of the particle transport algorithms are new as is an algorithm to provide two-way momentum and energy coupling between the particle and carrier phases. Using these methods we investigate particle-laden turbulent jet flow. In contrast to other previous particle implementation in ODT, the two new methods allow the particles to interact with multiple eddies simultaneously and evolve the particle phase continuously, and therefore are able to accurately capture turbulent mixing and fluctuation seen by inertial particles in ODT. Simulation results are compared with experimental data including the effect of two particle Stokes numbers (St = 3.6 and 10.8). Turbulence modification, particle number density PDFs and particle velocity evolution are presented.

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