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A New Dual-timescale Langevin Model for Particle-laden Turbulent Flows MADHUSUDAN PAI GURPURA, SHANKAR SUBRAMANIAM, Iowa State University — Accurate prediction of particle dispersion and interphase turbulent kinetic energy (TKE) transfer is important in modeling multiphase flows. Direct numerical simulations (DNS) of canonical particle-laden turbulent flows reveal that particle dispersion statistics and dynamics (TKE) evolve over different timescales. Furthermore, each timescale behaves differently with Stokes number St_η, a quantity that characterizes how quickly a particle responds to the carrier phase turbulent fluctuations at the Kolmogorov scale. In decaying turbulence, particles with large St_η lose energy faster than particles with smaller St_η while, in stationary turbulence, particles with larger St_η lose correlation with their earlier velocities slower than particles with smaller St_η. It is desirable for two-phase turbulence models to capture these disparate timescales in canonical particle-laden flows in order to be predictive in more complex multiphase computations. A new dual-timescale Langevin model (DLM) is proposed that features different timescales for the drift and diffusion terms, and is successful in capturing the behavior of the disparate timescales associated with dispersion and dynamics in a two-phase flow. Model predictions are compared with results from DNS of canonical particle-laden turbulent flows.

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