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Particle acceleration model for gas–solid suspensions at moderate Reynolds numbers SUDHEER TENNETI, RAHUL GARG, Iowa State University, CHRISTINE HRENYA, University of Colorado, RODNEY FOX, SHANKAR SUBRAMANIAM, Iowa State University — Particle granular temperature plays an important role in the prediction of core annular structure in riser flows. The covariance of fluctuating particle acceleration and fluctuating particle velocity governs the evolution of the granular temperature in homogeneous suspensions undergoing elastic collisions. Koch and co–workers (Phys. Fluid. 1990, JFM 1999) showed that the granular temperature has a source term due to hydrodynamic interactions in gas–solid suspensions in the Stokes flow regime. We performed direct numerical simulations (DNS) of freely evolving suspensions at moderate Reynolds numbers using the immersed boundary method (IBM). We found that simple extension of a class of mean particle acceleration models to their instantaneous counterparts does not predict the correct fluctuating particle acceleration–fluctuating velocity covariance that is obtained from DNS. The fluctuating particle velocity autocorrelation function decay and the Lagrangian structure function obtained from DNS motivate the use of a Langevin model for the instantaneous particle acceleration.

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