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Effect of hydrodynamic forces on particle velocity fluctuations in suspensions at moderate Reynolds number[1] SUDHEER TENNETI, RAHUL GARG, RODNEY FOX, SHANKAR SUBRAMANIAM, Iowa State University — Direct numerical simulations (DNS) of monodisperse suspensions with high particle inertia and moderate fluid inertia are performed using an immersed boundary method (IBM) to quantify the effect of hydrodynamic forces on particle velocity fluctuations. The evolution of the second moment of particle velocity fluctuations is driven by the correlation between fluctuating particle acceleration and fluctuating particle velocity. This correlation arises in part due to hydrodynamic interactions with neighboring particles, and it is not satisfactorily predicted by existing drag laws for the particle acceleration used in conjunction with the particle velocity distribution. A new Langevin model for the fluctuating particle acceleration is proposed, which yields promising results when compared with the DNS data. The source and sink terms in the particle velocity second moment equation that arise due to hydrodynamic interactions are quantified using the DNS data.

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