DNS of fully resolved spherical particles dispersed in isotropic turbulence

FRANCESCO LUCCI, University of California, Irvine, ANTONINO FERRANTE, California Institute of Technology, SAID ELGHOBASHI, University of California, Irvine — Our DNS study concerns the interactions between decaying isotropic turbulence and solid spherical particles with diameter, $d$, larger than the Kolmogorov length scale, $\eta$. We employ an Immersed Boundary method similar to that of Uhlmann (JCP, 2005) to resolve the flow around 6400 spherical particles with a volume fraction of $\phi_v = 0.1$. The monosize particles have a diameter, $d = 16\eta_0$. Our simulations, with $256^3$ mesh points and $Re_{\lambda_0} = 75$, cover a range of $38 \leq \tau_p/\tau_{K_0} \leq 149$, for the ratio of the particle response time to the initial Kolmogorov time scale. A Lagrangian approach is used to compute the frequency spectrum of the turbulence kinetic energy (TKE) of the fluid phase. The effects of varying $\tau_p/\tau_{K_0}$ on the spectrum and the decay rate of TKE are discussed. The effects of the formation of the particle boundary layer on the viscous dissipation rate of TKE are also discussed.

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