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The effects of upstream turbulence on flow through random arrangements of spheres YING XU, MADHUSUDAN G. PAI, SHANKAR SUBRAMANIAM, Mechanical Engineering Dept. Iowa Sate Univ — We perform Direct Numerical Simulations (DNS) of flow at moderate Reynolds numbers (based on mean flow velocity and particle diameter) through random arrangements of stationary spheres with varying levels of upstream turbulence. A pseudo-spectral implementation of the immersed boundary method is used to solve the Navier-Stokes equations with exact boundary conditions on each particle's surface. The simulations are used to probe the effects of upstream turbulence on the mean drag force experienced by the particles. Similar calculations for flow past a single sphere by Yusof (PhD Thesis, Cornell Univ. 1996) show that upstream turbulence can destabilize the wake behind the sphere and result in increased the drag. These calculations allow us to study the combined effects of particle shielding and upstream turbulence.

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