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Direct Numerical Simulations of Particle-Flow Interactions in a Channel ANAND SAMUEL JEBAKUMAR, Purdue University, KANNAN PREMNATH, University of Colorado, Denver, JOHN ABRAHAM, San Diego State University — Particle-laden flows are important in many energy applications including coal combustors, gasifiers and internal combustion engines. In a recent study, Lau and Nathan (2014) reported that particles in a turbulent pipe flow migrate preferentially either toward the axis or the wall depending on their Stokes number. They attribute this preferential migration to two forces: Saffman lift, which arises due to the mean velocity gradient across the particle, and turbophoretic force, which arises due to a gradient in the turbulent kinetic energy across the particle. In order to understand the interaction of particles with turbulence in a wall-bounded flow and the effect of these forces, we have performed Direct Numerical Simulations (DNS) of particle-flow interactions in turbulent channel flow. The Lattice Boltzmann Method (LBM) is employed for these DNS studies. The effects of particle size, Reynolds number, and Stokes number are considered in the analysis. The corresponding mean velocity and turbulent kinetic energy gradient as well as their effect on the force acting on the particle is examined.

Anand Samuel Jebakumar
Purdue University

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