Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Point-Force Energy Coupling TRISTAN BURTON, U.S. Naval Academy, KYLE SQUIRES, Arizona State University — Fully resolved simulations of particle-laden turbulent flows are computationally expensive even with a single particle. Therefore, simulations of flows with realistic numbers of particles typically treat the disperse phase as point-particles and models are used to account for the interaction between the phases. The particle trajectories are determined using a Lagrangian particle equation of motion that accounts for the fluid forces. The effect of the particulate phase on the fluid is included using point-force momentum coupling, where the opposite of the force applied to each particle by the fluid is distributed back to fluid grid points in a local region. In this work, we perform direct numerical simulation (DNS) of a particle moving at a prescribed constant or time-dependent velocity through a stationary fluid, and use the resulting force history in a corresponding point-force simulation to study point-force energy coupling. The energy input from the moving particle and the fluid dissipation in the DNS are compared to corresponding quantities in the unresolved calculation. A range of particle Reynolds numbers and ratios of the particle diameter to the unresolved grid spacing are considered to determine the conditions under which point-force momentum coupling provides accurate energy coupling.

Tristan Burton
U.S. Naval Academy

Date submitted: 15 Aug 2005 Electronic form version 1.4