Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Rolling and resuspension of a particle for explanation of Shields diagram HYUNGOO LEE, S. BALACHANDAR, University of Florida — Recent research (Zeng et al. 2009, Lee & Balachandar 2010) has shown that both the shear- and wall-induced lift contributions on a particle sharply increase as the gap between the wall and the particle is decreased. Explicit expressions that are valid over a range of finite Re were obtained for the drag and lift forces in the limiting cases of a stationary particle in wall-bounded linear flow and of a particle translating parallel to a wall in a quiescent ambient. Here we consider the more general case of a translating and rotating particle in a wall-bounded linear shear flow where shear, translational and rotational effects superpose. We have considered a modest Reynolds number range of 1-100. Direct numerical simulations using immersed boundary method were performed to systematically figure out the characteristics of hydrodynamic forces on a finite-sized particle moving while almost in contact with a wall. We present composite correlation for the hydrodynamic forces which are in agreement with all the available low-Reynolds- number theories. Also, obtained lift, drag and torque are used to explain the Shields diagram.

S. Balachandar
University of Florida

Date submitted: 10 Aug 2010 Electronic form version 1.4