Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Friction and drag forces on spheres propagating down inclined planes[1] YI HUI TEE, ELLEN LONGMIRE, Aerospace Engineering and Mechanics Department, University of Minnesota — When a submerged sphere propagates along an inclined wall at terminal velocity, it experiences gravity, drag, lift, and friction forces. In the related equations of motion, the drag, lift and friction coefficients are unknown. Experiments are conducted to determine the friction and drag coefficients of the sphere over a range of Reynolds numbers. Through high speed imaging, translational and rotational velocities of spheres propagating along a glass plate are determined in liquids with several viscosities. The onset of sliding motion is identified by computing the dimensionless rotation rate of the sphere. Using drag and lift coefficients for Re <350 obtained from numerical simulations by Rao et al. (JFM, 2012), both static and kinetic friction coefficients are calculated for several materials. The friction coefficients are then employed to estimate the drag coefficient for 350 <Re <2000. The resulting drag curve for a sphere propagating along a wall demonstrates the importance of the frictional force over this Re range.

[1]Supported by NSF (CBET-1510154).

Yi Hui Tee
Aerospace Engineering and Mechanics Department, University of Minnesota

Date submitted: 31 Jul 2017 Electronic form version 1.4