Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Simulating colloidal hydrodynamics near a solid surface with a modified approach: more physics, less mathematics MD MAHMUDUR RAHMAN, STUART WILLIAMS, University of Louisville — We studied behavior of hard-sphere colloids located near a solid surface in a cylindrical confinement which was rotated horizontally at slow and uniform speed. The flow field caused by a single particle's mobility near a solid surface was determined using an image system. Pair-wise flow field was further modified by the reflection from an entrained particle due to the disturbance flow, caused by a moving particle, in the form of either torque, stresslet, or both depending on entrained particle's location with respect to the direction of the moving particle's motion. To ensure non-overlapping particle's mobility, we used hypothetical center-to-center colloid repulsion model which was balanced by the viscous drag. To ensure particles' motion were confined within the sidewall boundary, we used reduced force model which mostly affect to the nearby particles at the boundary. This modification estimated reduced drag and caused error near the boundary which is minimized by the sufficiently larger simulation space. We validated observed simulated structures formation through experimentation. We observed colloids, both from experimentation and simulation, formed similar dynamic structures and clusters while laterally migrating away from the surface.

Md Mahmudur Rahman
University of Louisville

Date submitted: 11 Aug 2020 Electronic form version 1.4