Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Simulating flow and segregation of cylindrical particles YONGZHI ZHAO, Zhejiang University, PAUL B. UMBANHOWAR, RICHARD M. LUEPTOW, Northwestern University — Efficient and accurate simulation of cylindrical particles using discrete element method (DEM) is a challenge. Typical approaches to simulating cylindrical particle systems are based on the glued spheres method, which has low accuracy, or real shape models, which have high computational cost. In this work we utilize super-ellipsoids, which belong to super-quadrics, to model cylindrical particles in DEM simulations. Simulations of a single cylinder impacting a flat wall indicate that super-ellipsoids provide the same accuracy as real shape models and much better accuracy than the glued sphere method. Simulations of super-ellipsoid cylindrical particles in rotating tumblers result in nearly the same angle of repose as experiments and real shape simulations, demonstrating the accuracy of super-ellipsoid DEM simulations for multi-particle systems. The segregation of bidisperse cylindrical particles differing in length in a bounded heap was simulated by super-ellipsoid DEM, and the results are similar to the experiment. In spite of these advantages of using super-ellipsoid cylindrical particles, simulations of filling a box with particles indicate that the simulation times for super-ellipsoid cylinders is about an order of magnitude longer than that for the same number of spherical particles.

Richard Lueptow
Northwestern University

Date submitted: 30 Jul 2015 Electronic form version 1.4