Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Kinetic theory based computational approaches for granular flows

PRAKASH VEDULA, University of Oklahoma, Norman — Challenges for efficient computational prediction of granular flows arise particularly due to their nonequilibrium behavior, as a result of which the continuum field assumptions become invalid (especially when the effective Knudsen number is not a small parameter). To address some of these challenges, we present computational methods for treatment of granular flows including particle rotation effects, based on solution of the corresponding Boltzmann equation with full collision operator using fixed-lattice and adaptive quadrature based approaches. Nonequilibrium behavior in dilute granular flows consisting of smooth and rough spheres will be investigated. The effects of inelasticity and mass distribution of the constituent spheres will also be discussed. Detailed treatment of the collision operators in our approaches ensures that the collision invariants are preserved and the functional dependence of evolution of generalized moments (involving linear and angular velocity components) is correctly represented. Semi-analytic representations of the moment contributions due to collision operator, which involve fourteen dimensional integrals, will also be developed. Microscopic dynamics of binary collisions is considered to relate pre-collisional and post-collisional linear and angular velocities of particles.

Prakash Vedula
University of Oklahoma, Norman

Date submitted: 05 Aug 2011 Electronic form version 1.4