Physics of Fluids
Submitted (2001)

The Effects of Continuous Size Distributions on the Rapid Flow of Inelastic Particles

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Molecular-dynamics simulations are employed to investigate the stresses and granular energy in granular materials with Gaussian and lognormal size distributions. Specifically, smooth circular disks engaged in unbounded two-dimensional shear flow are simulated using an event-driven algorithm. The resulting stresses, when non-dimensionalized with the root-mean-square diameter, are found to remain relatively constant as the widths of the particle size distributions are increased away from the monodisperse limit. As a consequence, the stresses predicted by monodisperse kinetic theory (using the root-mean-square diameter) are reasonably accurate in the Gaussian and lognormal systems studied herein. This width-independent nature of the total stresses is traced to an effective balancing of the stresses between the larger particles, which generate relatively high stresses, and smaller particles, which generate lower stresses. Moreover, similar to binary-sized systems, the granular energy in Gaussian and lognormal systems is found to be unequally distributed among the various sizes of particles, with large particles possessing more granular energy than their smaller counterparts (i.e., an equipartition of energy is *not* observed). This difference in granular energy between two particles increases with both inelasticity and the size difference.