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The Simple Shear Flow of Granular Materials with a Lognormal Particle Size Distributions

S. R. Dahl, R. Clelland[*], and C. Hrenya
Department of Chemical Engineering
[*]Department of Mathematics
University of Colorado at Boulder

Granular flows in nature and industry often contain particles of many sizes. Nevertheless most of the theoretical and experimental work to date has focused on granular flows with either monodisperse or binary particle size distributions. Many granular materials may be adequately represented as continuous distributions (e.g., Gaussian or lognormal distributions), providing incentive for the investigation of granular flows with these particle size distributions. As an extension of previous work for Gaussian particle size distributions, granular flows containing particles with lognormal size distributions were investigated as part of this study. Event-driven, discrete-particle ("molecular-dynamic") simulations were employed to elucidate information about the stresses and granular energy in the simple shear flow of granular materials with lognormal particle size distributions. A wide parameter space was investigated, including a range of distribution widths, coefficients of restitution and solids concentrations. Similar to Gaussian size distributions, the results indicate that the dimensionless stresses appear to remain relatively constant as the width of the lognormal distribution is increased from the monodisperse limit.