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Simple Shear Flow of Granular Materials with a Smooth Size Distribution

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The granular flows that occur in nature and industry are typically polydisperse in nature, and are often characterized by a smooth distribution of particle sizes. The aim of most previous efforts, however, has been on monodisperse and binary size distributions. In the current work, discrete particle ("molecular-dynamic") simulations are used to determine the stresses displayed by granular materials characterized smooth size distributions. The flow field under consideration is simple shear, and the particles are assumed to be smooth, inelastic disks. Simulations are performed for both symmetric and asymmetric size distributions (e.g., Gaussian and lognormal). Furthermore, the parameter space examined includes a range of solids fractions, coefficients of restitution, and widths of size distributions. The resulting normal and shear stresses are determined, and are compared with predictions from existing kinetic theories for monodisperse systems.