# Discrete-Particle Simulation of Cohesive, Inelastic Grains in Simple Shear Flow

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Cohesive forces play a significant role in solids flows occurring in nature and industry (e.g., solids handling). These forces arise from a number of different sources, Van der Waals forces, liquid bridging, and electrostatic forces. Despite their prevalence, however, a fundamental understanding of the effects of interparticle forces on solids flow behavior is lacking.

In this study, a simple model for cohesive forces has been incorporated into a discrete-particle simulation. In particular, a square-well potential is used to describe the interaction between particles. The range of the square well is defined by an outer radius ($R_o$) which is greater than the true radius (R) of each particle. When two approaching particles reach a distance of 2 $R_o$ apart, they experience an instantaneous velocity change that results in their trajectories being more head-on. At a separation distance of 2R, the particles experience an inelastic, repulsive collision. For particles moving away from each other and whose centers are less than $2R_o$ apart, a second cohesive interaction occurs as their outer radii cross. During this second interaction, if the particles do not have enough energy to escape the square well, they form an agglomerate. Such agglomerates may or may not be broken apart via a subsequent collision with another particle.

Qualitatively, the simulation is able to predict the formation, growth, and breakup of particle aggregates, as is expected for cohesive systems. Quantitatively, the results indicate the effect of the particle parameters (thickness and depth of square well and coefficient of restitution) on the observed stresses.