

Discrete-particle simulations of cohesive granular flow using a square-well potential

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Abstract

In the present study, rapid granular flows with attractive inter-particle forces are investigated. In particular, cohesive forces are incorporated into hard-sphere (molecular dynamics) simulations via a square-well potential. The square-well potential treats cohesive forces as both binary and instantaneous. For simple shear flows, an investigation of the input parameter space indicates that two distinct flow regimes are present. For relatively large cohesive forces, the formation of a large, single agglomerate is observed. For moderate cohesive forces, the sheared system is composed of mostly 2-particle, dynamic agglomerates that are fairly evenly distributed throughout the domain. Furthermore, the results for this latter regime indicate that cohesion attenuates the magnitude of the stress components at higher solids fractions (in the collisional regime) as compared to the non-cohesive case. At lower solids fractions (kinetic regime), however the presence of cohesive forces has little impact on the observed stress.

Key words

Granular flows, Cohesion, Agglomeration, Molecular dynamics, Square-well potential

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