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Dynamics of singlet-doublet collisions of cohesive particles

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Abstract

As a first step toward a more physical understanding of the outcome of collisions between cohesive agglomerates, the dynamics of a cohesive particle (singlet) impacting an agglomerate of two particles (doublet) are studied via DEM simulations. Four collision outcomes are observed in simulations, namely "agglomeration", "bounce", "transfer" and "breakage". The occurrence of each outcome shows complex dependency on the pre-collisional configurations, which has four degrees of freedom that characterize the position and velocity of the singlet. Sweeping the parameter space of the pre-collisional configurations reveals the existence of oscillatory transitions across the different collision outcomes with increasing speed of the singlet, in contrast to the unique transition criterion for binary collisions. Detailed kinematical analysis indicates the oscillatory transitions are consequences of multiple, consecutive impacts between the singlet and the two particles in the doublet. By summarizing the numerical results in non-dimensional form, a general method is proposed to estimate the critical speeds of the singlet at the transition of collision outcomes. The findings provide insights on establishing closures for the kinetic theory-based continuum models coupled with population balance to predict the

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