Experimental Investigation of Segregation Mechanisms in Horizontally Shaken Granular Media

Takato, Mikiko

Granular segregation is a counterintuitive phenomenon in nonlinear physics where granular particles in binary granular mixtures sort by size under excitation. Although segregation is a very common phenomenon in industrial settings and in the natural world, scientists are not sure why is occurs. The purpose of this investigation is to elucidate the fundamental mechanisms that cause granular segregation by size to occur in horizontally shaken granular systems. I hypothesized that segregation occurs when the force that pushes the larger particles of the binary mixture together are greater than the force that pushes them apart. I also predicted that the difference in the magnitude of the two forces is dependent on the distance between the larger particles. A mathematical model for the timescales of segregation was set up based on this hypothesis. This model was tested experimentally by tracking the individual and collective behavior of particles in granular mixtures. The results of this investigation support the original hypotheses and agree with the presented model. The speed of segregation was observed to be directly proportional to the difference in the magnitudes of the force that pushes the particles together and the force that pushes them apart. The results of this investigation also hint that segregation can occur due to differences in density, not just size. This leads me to hypothesize that the differential mobility of granular particles in a mixture is what causes segregation. The next step is to test this hypothesis.

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