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Packing and segregation in thermally cycled granular materials
KE CHEN, JOHN DRASKOVIC, Physics Dept. of Penn State Univ., JULIA COLE, Aerospace engineering Dept. of Penn State Univ., ANDREW HARRIS, CASEY CONGER, MATTHEW LOHR, Physics Dept. of Penn State Univ., KIT KLEIN, Dept. of Computer Engineering of Penn State Univ., THOMAS SCHEIDEMANTEL, PETER SCHIFFER, Physics Dept. of Penn State Univ. — We have studied the change of packing fraction of granular materials and the displacement of an intruder in a granular pile under thermal cycling. We find that the packing fraction of granular materials increases with thermal cycling, i.e., heating the sample and returning it to ambient temperature. This effect appears to be related to the difference in thermal expansion between the container and the grains, and it increases monotonically with increasing cycle temperature. The packing fraction further increases under multiple thermal cycles and the increasing packing fraction can be fit to a double exponential decay toward the random close packing. We also find that spherical intruders in granular piles can move downward with thermal cycling, and that this effect depends on the relative density of the grains and the intruder as well as the relative thermal expansion of the grains and the container. This research was supported by the NASA through grant NAG3-2384 and the NSF REU program through grant DMR 0305238.

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