Abstract Submitted
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Stability and Structure of Star-Shape Granules[1] YUCHEN ZHAO, JONATHAN BARES, Physics Department, Duke University, MATTHEW ZHENG, North Carolina School of Science and Mathematics, KAROLA DIERICHS, ACHIM MENGES, Institute for Computational Design, University of Stuttgart, ROBERT BEHRINGER, Physics Department, Duke University — Columns are made of convex non-cohesive grains like sand collapse after being released from initial positions. On the other hand, various architectures built by concave grains can maintain stability. We explore why these structures are stable, and how stable they can be. We performed experiments by randomly pouring identical star-shape particles into hollow cylinders left on glass and a rough base, and observed stable granular columns after lifting the cylinders. Particles have six $9\,mm$ arms, which extend symmetrically in the xyz directions. Both the probability of creating a stable column and mechanical stability aspects have been investigated. We define r as the weight fraction of particles that fall out of the column after removing confinement. r gradually increases as the column height increases, or the column diameter decreases. We also explored different experiment conditions such as vibration of columns with confinement, or large basal friction. We also consider different stability measures such as the maximum inclination angle or maximum weight a column can support. In order to understand structure leading to stability, 3D CT scan reconstructions of columns have been done and coordination number and packing density will be discussed.

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