Abstract Submitted
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Stratification of size-bidisperse granular mixtures in a quasi-2D bounded heap with periodic flow modulation[1] HONGYI XIAO, ZHEKAI DENG, PAUL UMBANHOWAR, JULIO OTTINO, RICHARD LUEPTOW, Northwestern University — Segregation of disperse granular materials in unsteady flows is ubiquitous in nature and industry, yet remains largely unexplored. In this study, unsteady flows are generated by feeding size-bidisperse granular mixtures onto a quasi-2D bounded heap using alternating feed rates, which results in stratified layers of large and small particles. The mechanism of stratification is investigated in detail using Discrete Element Method (DEM) simulations of the flow. During the transition from the slow to the fast feed rate, a segregating wedge propagates downstream and forms a large particle layer extending upstream. During the opposite transition, upstream segregated small particles relax downstream and form a small particle layer extending downstream. The transient kinematics from DEM simulations are quantified and used to inform a time-dependent continuum model that captures the interplay of advection, diffusion, and segregation in the flowing layer. The continuum model reproduces the principle characteristics of the stratification patterns observed in experiments and simulations.

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