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Stratification, segregation and mixing of bi-disperse granular materials in quasi-2D heaps[1] RICHARD LUEPTOW, YI FAN, PAUL UMBANHOWAR, JULIO OTTINO, Northwestern University, Evanston, IL — Segregation and mixing of granular mixtures during heap formation have important consequences across a range of contexts, from chemical processing to construction to agriculture. This research investigates three different final particle configurations of bi-disperse granular mixtures of spherical particles - stratified, segregated and mixed - during filling of quasi-two dimensional silos. We considered a larger number and relatively wider range of control parameters than previous studies, including particle size ratio, flow rate, system size, and heap rise velocity. The boundary between the stratified and unstratified states is primarily controlled by the two-dimensional flow rate, with the critical flow rate for the transition depending weakly on particle size ratio and flowing layer length. In contrast, the transition from segregated to mixed states is controlled by the rise velocity of the heap, a control parameter not previously considered. The critical rise velocity for the transition from a segregated state to a mixed state depends strongly on the particle size ratio.

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