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Stability of an isolated granular band in a rotating tumbler PAUL B. UMBANHOWAR, DARIUS WHEELER, JULIO M. OTTINO, RICHARD M. LUEPTOW, Northwestern University — Granular mixtures tend to segregate into axial bands when tumbled in long, horizontal cylinders. To better understand this phenomenon we experimentally and computationally studied the stability of a single band of large spherical particles initially located between two regions of small spherical particles. Unlike previous work with bidisperse particles, where the band spread axially in a diffusive-like fashion, we found that a single band can stabilize to a constant width much smaller than the cylinder length depending on the size ratio of large to small particles, R, and the fill fraction of the tumbler, f. Stable bands were observed for $f < 0.3$ and $1.3 \leq R \leq 2.3$; for R outside this interval and $f > 0.3$, bands were unstable and grew diffusively. For $R < 1.3$ large particles diffuse axially in the flowing layer, while for $R > 2.3$ axial motion of large particles occurs mainly at the intersection of the downstream terminus of the flowing layer and the cylinder wall. Lastly, band stability was independent of initial band width for the range we tested (4-40 mm). We discuss possible band stabilization mechanisms in light of these observations.

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