Abstract Submitted
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Application of dynamical systems tools to mixing in quasi-2d and 3d tumblers[1] STEVEN W. MEIER, Northwestern University, ROB STURMAN, University of Leeds, RICHARD M. LUEPTOW, Northwestern University, STEPHEN WIGGINS, University of Bristol, JULIO M. OTTINO, Northwestern University — Granular mixing in rotating tumblers is countered by the tendency of the flow to induce segregation by particle size or density. The study of the competing underlying dynamics becomes complicated. However, all of the nontrivial dynamics takes place in a thin flowing surface layer. This observation, coupled with experimental measurements of the variation of the flow with depth in the surface layer and with tumbler geometry, leads to a continuum-based dynamical systems framework applicable to time-periodic flow in quasi-2d and 3d tumblers rotated about one or more axes of rotation. The case of time-periodic systems, in its simplest version, can be viewed as a mapping of a domain into itself. The placement of periodic points is investigated using symmetry concepts; the character of the periodic points and associated manifolds provide a skeleton for the flow and a template for segregation processes. Experiments validate the theoretical construction of time-periodic flows as maps.

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