Abstract Submitted
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Discrete Models for Mixing in 2D Granular Tumblers[1] STEPHEN E. CISAR, Department of Chemical and Biological Engineering, Northwestern University, RICHARD M. LUEPTOW, Department of Mechanical Engineering, Northwestern University, JULIO M. OTTINO, Department of Chemical and Biological Engineering, Northwestern University — An effective method to study mixing of granular materials in a variety of cases is through the use of discrete models. We study the mixing of granular materials in 2D tumblers rotating in the avalanching regime using two different discrete models. First, since mixing in the avalanching regime is well suited for a geometric interpretation, we use a model based on mapping of wedge avalanches along with random mixing within the wedge. Second, we develop a cellular automata (CA) model based on comparing the heights of columns of particles in the CA grid that results in irregular avalanching and mixing of particles. We compare mixing of like particles in tumblers of various shapes and fill levels using both models. Mixing rates for half-full tumblers demonstrate a strong dependence on the symmetries of the tumbler shape. More than half-full tumblers contain a core of unmixed particles with a shape that changes with fill level. Together with the overlapping of wedges, this results in multiple extrema when the mixing rate is plotted as function of fill level. While the two models produce qualitatively similar results, the cellular automata model is substantially more flexible and typically runs in about $1/10^{th}$ of the time.

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