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Modeling Size Polydisperse Granular Flows[1] RICHARD M. LUEPTOW, CONOR P. SCHLICK, AUSTIN B. ISNER, PAUL B. UMBANHOWAR, JULIO M. OTTINO, Northwestern University — Modeling size segregation of granular materials has important applications in many industrial processes and geophysical phenomena. We have developed a continuum model for granular multi- and polydisperse size segregation based on flow kinematics, which we obtain from discrete element method (DEM) simulations. The segregation depends on dimensionless control parameters that are functions of flow rate, particle sizes, collisional diffusion coefficient, shear rate, and flowing layer depth. To test the theoretical approach, we model segregation in tri-disperse quasi-2D heap flow and log-normally distributed polydisperse quasi-2D chute flow. In both cases, the segregated particle size distributions match results from full-scale DEM simulations and experiments. While the theory was applied to size segregation in steady quasi-2D flows here, the approach can be readily generalized to include additional drivers of segregation such as density and shape as well as other geometries where the flow field can be characterized including rotating tumbler flow and three-dimensional bounded heap flow.

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