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Random-Packing Dynamics in Dense Granular Flow MARTIN Z. BAZANT, CHRIS H. RYCROFT, KENNETH KAMRIN, Department of Mathematics, MIT — The jamming transition of disordered hard spheres has attracted much recent attention, but how do slightly less dense random packings flow? Here, we propose a simple mechanism based on diffusing "spots" of free volume, which cause correlated displacements of neighboring particles. A multiscale algorithm, alternating between coarse-grained spot dynamics and microscopic particle relaxation, can produce realistic flowing packings, and yet is also convenient for mathematical analysis of mean flow and diffusion. We apply the model to granular drainage from a silo and fit three basic parameters (spot size, volume, and diffusivity) to brute-force simulations by the discrete-element method. For a wide silo, we find that the spot simulations can largely reproduce the dynamics of 100,000 frictional, visco- elastic spheres in the DEM simulations, while running over 100 times faster, although a general model for the spot dynamics in different geometries is still lacking. This may come from a stochastic reformulation of Mohr-Coulomb plasticity, where spots undergo random walks along slip planes.

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