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Effects of wall friction on flow in a quasi-2D hopper NEIL SHAH, University of Massachusetts, Amherst, SUMIT BIRWA, TCIS, Hyderabad, BRENDA CARBALLO-RAMIREZ, MOLLIE PLEAU, NALINI EASWAR, Smith College, SHUBHA TEWARI, University of Massachusetts, Amherst — Our experiments on the gravity-driven flow of spherical particles in a vertical hopper examine how the flow rate varies with opening size and wall friction. We report here on a model simulation using LAMMPS of the experimental geometry, a quasi-2D hopper. Keeping inter-particle friction fixed, the coefficient of friction at the walls is varied from 0.0 to 0.9 for a range of opening sizes. Our simulations find a steady rate of flow at each wall friction and outlet size. The Janssen effect attributes the constant rate of flow of a granular column to the column height independence of the pressure at the base, since the weight of the grains is borne in part by friction at the walls. However, we observe a constant flow regime even in the absence of wall friction, suggesting that wall friction may not be a necessary condition for pressure saturation. The observed velocities of particles near the opening are used to extrapolate their starting positions had they been in free fall. In contrast to scaling predictions, our data suggest that the height of this free-fall arch does not vary with opening size for higher frictional coefficients. We analyze the velocity traces of particles to see the range over which contact interactions remain collisional as they approach the hopper outlet.

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