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Flowability of powders and grains with application to industrial packaging

The design of bulk material handling equipment is a challenging issue for the packaging industry and requires a thorough understanding of the mechanical behaviour of granular materials at different environmental conditions. While packaging, a variety of material conveying techniques are used, which range from air fluidization to discharge of material through a hopper. Decision-making strategies towards selecting the adequate equipment often rely on qualitative estimations on the flowability of powders and bulk solids, thus lacking a robust approach to mass flow phenomena.

A new insight into the flowability of powders and bulk solids for industrial purposes will be presented, based on the experimental and numerical characterization of mass flows of different materials. A testing device has been developed and calibrated to perform granular column collapse tests, which allow observing the impact of particle packing configuration on the kinematics of flow using visualization methods. Moreover, discrete particle simulations are used to quantitatively link bulk-level observations to particle-level properties of the materials, besides enabling inverse analysis leading to indirect measures of micro-scale parameters.

