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Analysis of the flow of grains through a screw conveyor AASHISH GUPTA, PRABHU NOTT, Indian Institute of Science — Screw conveyors are widely employed in industry for the bulk transport of particulate materials. Several studies have attempted to correlate the discharge rate with the angular velocity of the screw and the pitch to diameter ratio via experiments and particle dynamics simulations. However, a detailed mechanical model that would assist in optimal design of screw conveyors, hasn't been attempted. In this study, we first construct a simple model that assumes the entire granular medium to move as a rigid body sliding along the surfaces of the screw and casing. By enforcing the balances of linear and angular momentum to a suitably chosen continuum element, we show that under certain limiting conditions, the discharge rate for a given angular velocity and screw geometry can be obtained. Further, the discharge can be maximized by setting the pitch to casing radius ratio to a particular value. We then study the detailed flow within the conveyor using the discrete element method and show that a significant fraction of the material exhibits solid body motion, in agreement with the simple model. We assess the effect of relaxing the limiting conditions employed in the model, thereby determining the connection between the friction at the walls and the discharge rate.

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