Title: Granular flow behavior in a conveyor system: from local velocity profiles to mass flow rate

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Predictability of consistent granular flow is critical in many industries. This exploration of behavior in a conveyor apparatus aims to fill a gap in knowledge of achieving a uniform mass flow rate by correlating local velocity profile data with summative mass measurements in both experiments and simulations. Differences between the two types of flow measurements indicate unwanted energy dissipation. In experiments, image data was collected for uniformly-sized particles in the bottom-driven flow conveyor belt system for which edge velocity profiles could be produced to measure local shear rates and estimate mass flow. These velocity relationships under different speeds of the belt and varied outlet sizes are compared to shear rates from gravity driven flow. Similarity in the linear profile transitioning to an exponential decay are observed but at shear rates substantially lower than dilated, free-surface flows. Simulations were conducted using LIGGGHTS discrete element model framework using the same dimensions for the conveyor system and particle sizes. Results show unique three-dimensional velocity profiles can produce similar mass flow rate behavior. The work continues to demonstrate computational models of granular flows with experimental validations can be used to evaluate customized designs in industrial applications, such as feeding unsteady biomass conversion reactors. Future work can be developed to evaluate granular materials that have random distribution of sizes, aspect ratios, and orientation.