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Using directional-specific shear rates to correlate mass flow rate and velocity profiles in a granular conveyor[1] NICHOLAS POHLMAN, HANNAH HIGGINS, MICHAEL ROEING-DONNA, JIFU TAN, Northern Illinois University — Velocity profiles and total mass flow rate of an industrial-style conveyor system with a storage hopper is explored using both experiments and simulation. Despite expectations of quasi-two-dimensional behavior, the velocity profiles observed at the side walls are not consistent throughout the stored material above the flighted conveyor belt. Integrating velocity profiles from high speed imaging of the experiment proved to underestimate the total mass flow rate of the system when different opening sizes and belt speeds were used. Simulations using the LIGGGHTS platform with boundary conditions similar to the experimental parameters confirm that velocity adjacent to the flights may be constant but non-uniform due to the jam-prevention gaps between flights and the walls. Results indicate that the shear rate decays differently in gravitational versus transverse directions. Fitting parameters for two unique shear rates were applied to allow better correlation of the velocity profiles and mass flow rates that were measured.

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Nicholas Pohlman
Northern Illinois University

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