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Resolving Two Dimensional Angular Velocity within a Rotary Tumbler[1] NATHANIEL HELMINIAK, DAVID HELMINIAK, VIKRAM CARIAPA, JOHN BORG, Marquette University — In this study, a horizontally oriented cylindrical tumbler, filled at variable depth with cylindrical media, was rotated at various constant speeds. A monoplane layer of media was photographed with a high-speed camera and images were post processed with Particle Tracking Velocimetry (PTV) algorithms in order to resolve both the translational and rotational flow fields. Although the translational velocity fields have been well characterized, contemporary resources enabled the ability to expand upon and refine data regarding rotational characteristics of particles within a rotary tumbler. The results indicate that particles rotate according to intermittent no-slip interactions between the particles and solid body rotation. Particles within the bed, not confined to solid body rotation, exhibited behavior indicative of gearing between particles; each reacting to the tangential component of contact forming rotation chains. Furthermore, it was observed that solid body interactions corresponded to areas of confined motion, as areas of high interaction dissuaded no-slip rotation, while areas of developing flow tended towards no-slip rotation.

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