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Rotational Dynamics of Dense Granular Systems. WOLFGANG LOSERT, University of Maryland College Park — This study builds on my post-doctoral work in the Gollub lab on particle tracking based analysis of dense granular flows. In the work presented here we analyze the reversibility of both translation and rotations of granular materials in three-dimensions under cyclic compression, Using transparent acrylic beads with cylindrical holes and index matching techniques, we are not only capable of tracking displacements but also able to follow rotations. We observe that for moderate compression amplitudes, up to one bead diameter, the translational displacements of the beads after each cycle become mostly reversible after an initial transient. However, granular rotations are irreversible. The translational and rotational displacements are only weakly correlated, indicating that rotational motion depends on more subtle changes in contact distributions. We are able to recreate these observations in particle dynamics simulations. Simulations allow us to assess the forces and torques in the system undergoing cyclic forcing.

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