

Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Granular Flow in a Rotating Drum: Dry vs. Submerged Flow

DENIZ ERTAS, HUBERT E. KING, ARNOLD KUSHNICK, FUPING ZHOU, ExxonMobil Research and Engineering, CHRISTOPHER BRISCOE, Levich Institute, City College of New York, PAUL CHAIKIN, New York University — We have experimentally studied granular flows in a cylindrical rotating drum, half-filled with nearly monodisperse spherical glass particles in order to investigate the effect of interstitial fluid on these flows. We have conducted two classes of experiments under otherwise identical conditions: The first with air as interstitial fluid and the second where the empty space in the cylinder was completely filled with water. For varying rotation rates, we used a particle tracking method to measure particle velocities near the side wall as a function of distance from the flow surface and the surface velocity as a function of distance from the side wall. In all cases, the velocity (relative to rigid rotational motion) initially decreases linearly from its surface value, followed by exponential decay, as a function of increasing distance from the surface. At a given rotation angle (i.e. overall flux), subaqueous flows exhibit more dissipation and therefore result in steeper surface slopes, a lower strain rate and deeper flows. The effect of the interstitial fluid weakens as rotation rate is lowered, resulting in the same slope in the limit of no rotation, i.e., angle of repose.

Deniz Ertas
ExxonMobil Research and Engineering

Date submitted: 16 Nov 2006

Electronic form version 1.4