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Cylindrical Sandpile Formation on Angularly Accelerated Horizontal Plane

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Here we report a formation of a cylindrical sand pile. A steady stream of dry sand is poured into a horizontally revolving cylindrical shell which is full up to a certain level with water. The water first forms a parabola which leaves the bottom of the cylindrical shell dry. The sand is poured of axis. The steady steam sand forms a cylinder with a parabolic cavity in the middle. For bigger granular sand particles this new developed cylinder is more stable than for smaller granular sand particles. The essential features of the system that produce the phenomenon are discussed and the robustness of the phenomena is demonstrated with experiments using different boundary conditions and sands.With the help of this experiment we observed the effect of capillary force on granule-fluid mixtures.

As a result of the centrifugal force fluids are thrown outwards if they are revolved in a rotating shell. The fluid which is forced outwards in a radial direction is replaced by a fluid stream in the axial direction so the fluid rotates over the wall. The sand particles which rotate with water at a distance from the wall are at equilibrium under the influence of centrifugal force, which is balanced by a radial pressure gradient. As the tangential velocity of the particles near the cylindrical wall is reduced, the radial pressure remains the same because of the decreasing centrifugal force. All of these circumstances cause the particle near the wall to flow radially inwards and because of continuity reasons to compensate these motion particles rises up and this motion forces the particles construct a cylindrical pile. The external flow occurring in the water is called secondary flow and plays a major role here by the development of our cylindrical sandpile . This secondary flows forces the downward flowing sand take a shape of a cylinder.

As the sand flows downwards and constructs the pile the capillary force from the base affects the pile and climbs up in the sandpile. This capillary movement causes to a negative pore pressure which makes the sand particles attract each other but as the capillary movement improves the negative pore pressure turns to neutral (or positive) and this causes the sand particles repel each other this time. So we observe that the cylindrical sand pile actually has wet side walls, wet inner volume but a dry parabolic surface over the pile. As the pore pressure turns into neutral or positive the pile formation becomes unstable from a metastable condition. It disperses as soon as the pore pressure forces it at maximum. The dispersion is not formed uniformly but occurs step wisely.