CERECAM SEMINAR

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Department of Physics

will speak on

Granular flow modeling in tumbling mills

DATE: Thursday 31 May
TIME: 2pm
VENUE: Room 226, Materials Engineering,
2nd level, Menzies Building

ABSTRACT

A continuum based granular flow model of charge motion that combines the inherent frictional nature of particles with its distinctly fluid-like structure is presented. Starting with Newton's 2nd Law on a volume element of charge, we derive the velocity field in the bed free surface and the rising *en-masse* region as illustrated below (figure overleaf). Invoking flux conservation within the two regimes of interest then yields a (simple) differential equation for the free-surface of the charge body (red curve in figure). Combining the velocity field equations with a suitable constitutive choice for the stress tensor completes the comminution picture with a description of the in-situ power dissipation in a tumbling mill – a mechanistically correct account of power dissipation in a tumbling mill.

For axial transport of the granular matter, we argue that material composed of different frictional properties diffuse (non-linearly) into axial bands due to concentration fluctuations in the free surface caused by friction-limited mobility. In this regard, a non-linear diffusion equation is derived using a collision-dominated shear stress according to Bagnold with the diffusion coefficient determined entirely from the boundary conditions.

Positron Emission Particle Tracking (PEPT) is used measure the in-situ flow fields for direct verification of the granular flow models. In this regard a wide range of milling conditions was investigated, forming the key ingredients to the abovementioned modeling philosophy.

Measured (via PEPT) time-averaged velocity field, probability distribution, and delineation of flow field into (dominant) distinct zones.