

Granular Flows Through Vertical Channels and Pipes

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Brief Biographical Sketch

Sovan Lal Das is a professor in the Department of Mechanical Engineering at IIT Palakkad. He holds a PhD in Theoretical and Applied Mechanics from Cornell University. His group's research concentrates on two main areas: (a) rapid flows of granular materials and (b) investigating the interaction of lipid-membranes with proteins and other macro-molecules towards developing antimicrobial drugs.

Abstract

We begin by reviewing the literature on the development of kinetic theory for the collisional flow of rigid, inelastic and frictionless particles and its extension to include deformation of and friction between the particles.

Subsequently, we discuss steady, fully developed, flows of soft, inelastic grains within a vertical chute and a pipe under the influence of gravity using extended kinetic theory (EKT). For every characteristic size, and within a range of flow rates, a region that is the analog of an erodible bed has been observed near the center of the channel/chute. We compare our results with those measured in recent discrete element simulations and see excellent agreement.

Finally we discuss our preliminary study on moderately dense, steady, fully developed flow of spherical particles in a vertical, circular pipe driven by a turbulent gas. We observe that the nature of the pipe boundaries has a strong influence on the particle and gas flow behavior.