Abstract Submitted
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The shear induced motion of a particle over a rough plane F. CHARRU, E. LARRIEU, J.-B. DUPONT, IMFT, France, R. ZENIT, IIM, UNAM, Mexico — The interaction of a spherical particle with a fixed rough bed in a simple shear viscous flow is studied experimentally. The shear flow is produced using an annular Couette cell which has a rectangular cross section and is filled with silicon oil. The rough bed consists of a monolayer of glued particles, randomly positioned on an annular ring placed on the bottom of the channel. By means of digital image particle tracking, the position of the test particle was obtained from a high speed video imaging system. The velocity of the particle was calculated in the stream, cross stream and vertical directions. Values of the mean and fluctuating components were calculated for a wide range of parameters, varying the particle size and density, the fluid viscosity and the mean shear, γ. It was found that the normalized stream-wise mean particle velocity U/U_S, where U_S is the Stokes settling velocity, depends only on the dimensionless shear rate, $\theta = \mu\gamma/(\Delta\rho g d)$, also called Shields number. This is consistent with the fact that the particle Reynolds number was smaller than 1 for most experiments. A simple model is proposed, based on a balance of hydrodynamic forces and a lumped friction force. Good agreement is found between the model predictions and the experiments.

Roberto Zenit
IIM-UNAM

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