Granular media friction explained: Da Vinci would be proud

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New York | Heidelberg, 12 July 2017 Leonardo Da Vinci had already noticed it. There is a very peculiar dynamics of granular matter, such as dry sand or grains of wheat. When these granular particles are left on a vibrating solid surface, they are not only subject to random vibrations, they are also under the spell of solid friction forces, like the force a dry floor would exert on a brick in contact with that floor. In a study published in *The European Physical Journal E*, Prasenjit Das from the Jawaharlal Nehru University, India, and colleagues extended our understanding of this problem from the well-known, one-dimensional case to multiple dimensions.

The trouble with the one-dimensional case is that it does not represent physical reality. In this study, the authors have solved the equation describing the effect of solid friction on granular materials for an arbitrary number of dimensions.

First, they considered that because the particle is affected by a vibrating random force, they cannot obtain its position and velocity with certainty. Therefore, they considered the probability distribution of its position. They then used an equation - the Fokker-Planck (FP) equation - to describe its evolution.

They managed to solve this equation, and obtain relevant physical quantities that are measurable experimentally to check the validity of their solution, by employing a simple analogy with another field, that of quantum mechanics and the solution to the famous Schrodinger equation

. Their results are in excellent agreement with numerical solutions in 2 and 3 dimensions.

This means that the model can also be used in further studies of a driven particle in a granular fluid, which is relevant to a number of industries, ranging from construction to pharmaceuticals. In this problem, a constant force acts on an intruder particle which interacts via two forces, namely the normal contact forces and friction forces, with the particles of the granular fluid.

More information: Prasenjit Das et al, Single particle Brownian motion with solid friction, *The European Physical Journal E* (2017). DOI: 10.1140/epje/i2017-11549-9

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