Sliding friction as mechanism of granular excitation

J. Pérez [1], M.E. Fernandez[2], D. Maza[3*] and M.A.S. Quintanilla [1]
1 Departamento de Electrónica y Electromagnetismo, Universidad de Sevilla, Sevilla, Spain.
2 Y-TEC, Departamento de Ingeniería Mecánica -Fac. Reg. La Plata -[UTN] Universidad Tecnológica Nacional, La Plata, Argentina.
3 Departamento de Física y Matemática Aplicada. Universidad de Navarra, Navarra, Spain.

We experimentally analyze the dynamics of a block resting on a horizontal oscillating surface. For small amplitude oscillations, the mass moves jointly the base but beyond certain amplitude threshold, the block start to slid as the block inertia overcomes the static friction. Stick-slip dynamics is then observed. As the surfaces interaction is highly inhomogeneous, noisy displacement could eventually be detected in the block dynamics. However, the mean displacement per cycle of the block is well defined. Importantly, for sufficiently large temporal observations, a net displacement for the block could be observed as the mechanical excitation is not perfectly symmetric. Such a net displacement happens in the same direction as the excitation amplitude, with deviations in the normal direction being negligible.

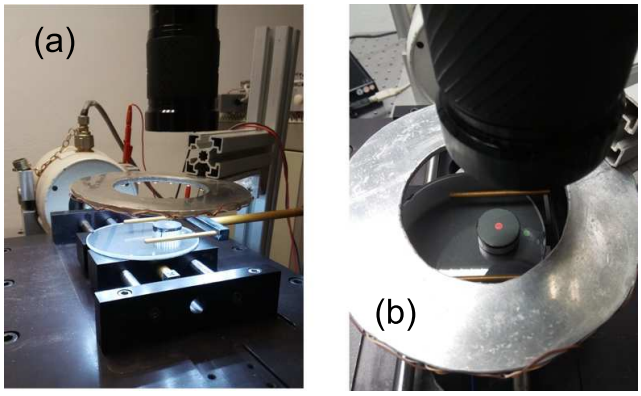

Figure 1: (a) Experimental setup. A glass base is horizontally shacked. An annular array of led lights illuminate the scene. (b) Closeup view of the region of interest. Platform and block detection points are coloured in green and red, respectively.

We introduce in the work the experimental setup and the preliminary results obtained for this type of excitations. The possibility of (partially) controlling the block displacement with asymmetric excitation signals points to use this device for inducing macroscopic granular dynamics. Figures 1.a and 1.b illustrate the experimental setup, consisting on a magnetic shaker, high speed camera, led array in circular configuration, moving platform and a sliding block.

[*] Corresponding author: dmaza@unav.es