Computational study of the granular flow through an elbow

O. Pozo Michelangelli, Ivan Sánchez and Ramón Darias

Institute for Polymers and Composites/I3N,
University of Minho, 4800-058 Guimarães, Portugal.

If a granular material inside a U-shaped tube is vertically vibrated, some interesting phenomena can be observed. Depending on the amplitude and frequency of vibration, the wall-grain interaction and the presence of an interstitial fluid, the granular material inside the tube can show a tendency to accumulate in one of his branches [1, 2]. The influence of the container walls on the granular material during the vibration and the temporal coupling between the motion of the container and the flowability of the grains, is not yet understood. The ability of the granular material to flow inside the container can vary in a single oscillation cycle, and be sensible the relation between grain size and tube diameter. In order to shed light on the role played by the walls on the grains flow and its temporal evolution during the vibration, we study through Discrete Element Method (DEM) the flow of grains in a half U-tube (L-shaped container), under vertical vibration. We investigate some rheological aspects from this system like the velocity and stress profiles, and their evolution in a single oscillation cycle. We explore how the amplitude and frequency of vibration affects the granular flow through the elbow of the tube and the influence of the walls on the net transport of grains.

[1] J.R. Darias, I. Sánchez, G. Gutiérrez. Experimental study on the vertical motion of grains in a vibrated U-tube. Granular Matter 13, 13-17, 2011.
[2] B. Pérez, I. Sánchez. Effect of friction on the granular U-tube instability. Mechanics Research Communications 38, 244-248, 2011.