BSc Thesis Project

Dynamics of Wet Granular Avalanches

Multiscale Mechanics (Utwente)

Avalanches and land sliding are hardly "predictable" and "controllable" issues that result in severe damages/losses in various ways. Therefore, understanding the possible causes and technology development for their prevention are challenging yet indispensable tasks for engineers. This project will combine numerical and experimental approaches in order to investigate the effect of a small amount of liquid on the avalanches dynamics. Furthermore, we will test if the avalanche flow can be substantially controlled by capillary forces between the particles (see Figure 2).

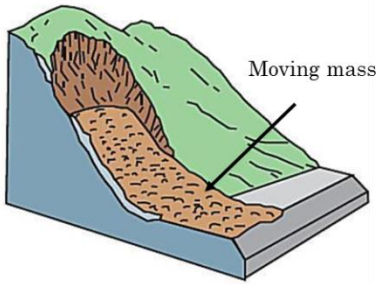

Figure 1. Wet slide avalanche

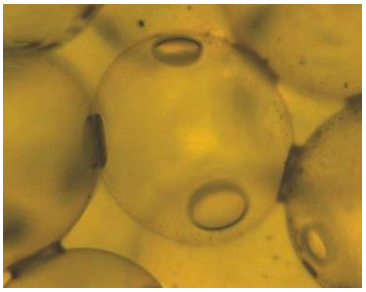

Figure 2. Close-up view of capillary bridges between particles

This will allow answering **challenging questions** such as:

- How does liquid affect the threshold above which avalanches are triggered?
- What's the effect of wettability of the particles on the avalanche velocity and flow?
- Is it possible to reduce avalanche occurrence through liquid cohesion (i.e. capillary forces)?

Main Goal: Investigate the effect of capillary forces on wet granular avalanches.

Method: Since the avalanche phenomena are hard to reproduce intentionally, pilot scale modeling and numerical simulation present powerful approaches to understand the key issues concerned. A drum rotating at a very low rotation speed (below 5 rpm, successive avalanches) will be adopted to mimic wet granular avalanches. DEM numerical approach will be used to study the effect of capillary forces on the dynamics of the avalanches (i.e. angle of repose, velocity gradient, maximum angle of stability and capillary force distribution). The numerical results will be compared to available experimental data. Additional experiments on a rotating drum available in the Multiscale Mechanics group may also be performed.

Contact people:

Vanessa Magnanimo (MultiScale Mechanics), email address: v.magnanimo@utwente.nl
Jarray Ahmed (MultiScale Mechanics), email address: a.jarray@utwente.nl