CEMRACS '08

Modelling and Numerical Simulation of Complex Fluids
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Modeling and Simulations of Erosion and Deposition in Avalanches

Project proposed by

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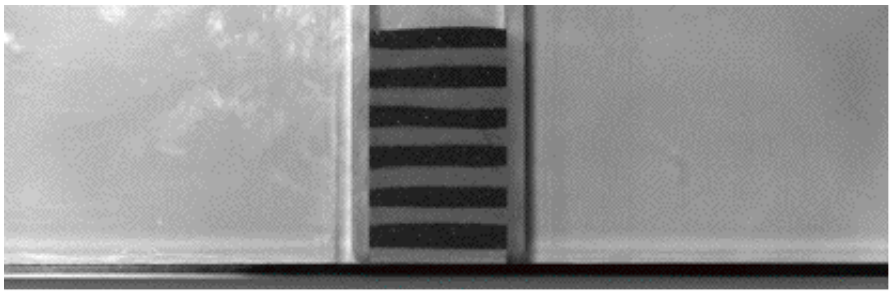
In this project we will deal with the problem of modeling erosion and deposition in avalanches. We plan to investigate the flowing layer of granular avalanches, by performing a variable transformation on local coordinates over the unknown interface between the static and flowing layers. Bouchut and Westdickenberg (2004) proposed a general coordinate (BW) for arbitrary topography, which could be the above mentioned unknown interface. In unified coordinate system (UC), the coordinate moves with some pseudo-particle, that it exhibits the advantages of both Eulerian and Lagrangian systems. Let these pseudo-particles coincide with the unknown interface, a new coordinate system moving with the erosion/deposition become possible. That is, by utilizing the benefit of the BW coordinate and UC system, a new model of granular avalanches can be derived, in which the erosion and deposition processes at the basal surface are considered. Figures displays the side view of a dry granular mass suddenly released on a horizontal plane. The granular mass was alternatively filled with layers of light brown and red sands. The region of the granular mass located inside a cone of bell form is not affected by the flows, i.e. it develops a surface flow along its edges while the bulk remains static. Another interesting feature is that the highest layers progressively cover over the lowest ones, which make the stratification on both sides. A mathematical model for the above experiment is still lacking. The aims of this project are as follows:

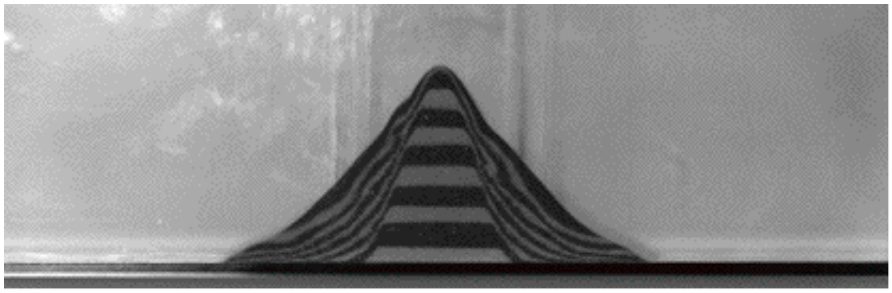
- Derivation of a mathematical model in which the erosion and deposition processes at the basal surface are considered.
- Implementation of numerical schemes for the model.
- Numerical result will be compared with the result of some new photographic techniques for measuring the instantaneous velocity fields as well as determining the basal surface.

Figures are Sequences of 2D images corresponding to Ottawa sand d=300-500?m on a horizontal plane.

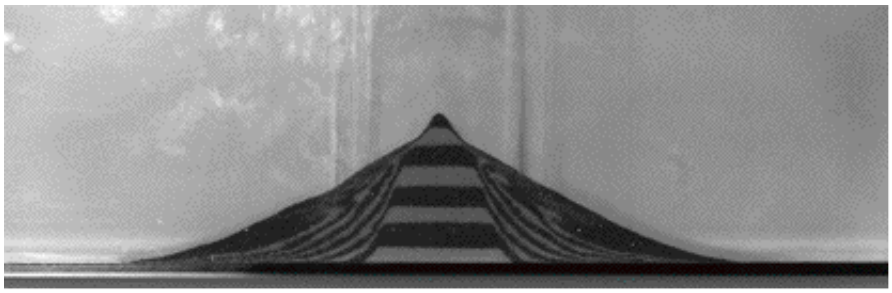
1. initial(t=0), when the whole pile is at rest.
2. after 0.36s there are surface flows on both sides.
3. 0 .86s later thin flows over the surface.
4. the final deposit after 0.94s.



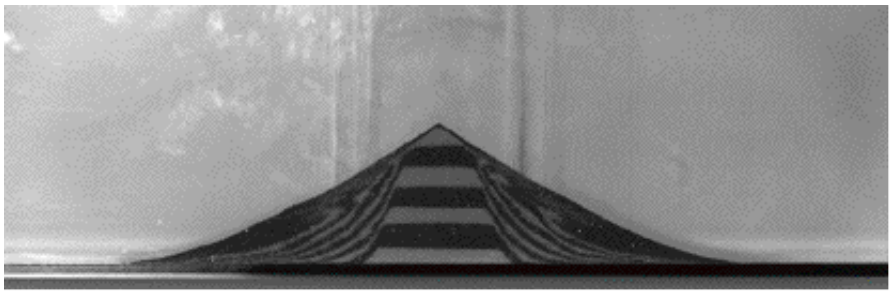
1.



2.



3.



4.