2011 Special Program: Two-Phase Flow, Interface Flow and Related Phenomena

Modeling dry granular flow with mixture theory

2011 - 10 - 19 (Wed.)
15:00 - 17:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

Traditionally, landslide (granular) flows are modeled as an incompressible single phase flow. This is based on the laboratory observations that the volume of the landslide flows after initiation keeps more or less a constant. However, the observations are made in relatively short chutes such that the flows are not allowed to develop before deposit. These observations hence contradict somewhat to the common knowledge that, with Coulomb friction law, the granular flow is continuously developing and so is the (air) void in the landslide materials. This streamwise development can be seen by observing granular flows in long chute.

In long chute, the friction force exerted to the flow by the chute surface causes the internal collisions and these collisions expand the mean free path between particles. As a result, the solid volume fraction decreases. In this seminar, our attempt to model this phenomenon with a continuum mixture model will be reported. In continuum mixture models, the volume fraction plays an important role in describing the inertials of the different phases and the interactions among them as well as air entrainment from the free surface into the flow. In addition, our experiments of measuring the solid volume fraction will also be briefed. Recent qualitative comparison between the theory and the measurement will be presented.