Department of Civil Engineering and Engineering Mechanics
Columbia University

Simulations of Granular Chute Flow: Application to Mobility of Landslides

Dr. Stanislav Parez

Institute of Earth Sciences, Hebrew University, Givat Ram, Jerusalem, Israel

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Time: 2:30 pm - 3:30 pm
Location: 253 Engineering Terrace

Abstract

For many decades now it has been known that large volume landslides have particularly long run-outs compared to small slides. The cause for the low apparent friction exhibited by the larger landslides has long been subject to speculations. We numerically model two-dimensional systems of dry granular particles flowing down an inclined plane, and decelerating on a flat plane thereafter. We derived an analytical theory, based on continuum mechanics and representative time scales analyses, that explains landslide velocity during its entire run as observed in our simulations. Landslide motion consists of 3 distinct stages: acceleration of flow down the slope, steady state flow down the slope if the slope is long enough to enable reaching this steady state, and deceleration on the flat. In the acceleration stage, the acceleration rate increases with landslide thickness, and leads to larger steady state velocity for lager landslides. In contrast, the deceleration rate on the flat is thickness independent. As a result the apparent friction decreases with increasing landslide thickness (volume), similarly to the natural slides.

http://www.civil.columbia.edu/ling/seminar
Host: Prof. Steve WaiChing Sun
Email: wsun@columbia.edu