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Experimental Study of the Collapse of Granular Columns

Li-Tsung Sheng[1], Shu-San Hsiau[1]
[1]Department of Mechanical Engineering, National Central University
No. 300, Zhongda Rd., Zhongli District, Taoyuan City 320317, Taiwan (R.O.C.)
li.tsung.sheng@gmail.com; sshsiau@cc.ncu.edu.tw

Extended Abstract

Rapid flows of granular materials driven by the gravity force are encountered in many geophysical contexts, which are instances of large-scale granular materials in motion. One of a famous issue about rapid flows is dam break phenomenon, which refers to the collapse of an infinite or finite volume of fluid, particles or their mixture onto a horizontal or inclined channel, where the flow is driven only by gravity. In the past, this issue attracts attention from many studies with using theoretical, experimental, and numerical investigations due to the rich flow behaviours it exhibits [1-6].

In this study, the collapse of dry granular column in a horizontal chute is investigated by several lab-scale experiments. Initially, the granular column is randomly packed with two different sizes particles at one side of the chute and held by a gate. Then, the column collapses by letting the gate leaves from the column. The effect of mixture-size particles on the collapse flow of the granular columns is discussed via using several size ratios of the size-bidisperse of granular column to test in the experiments. In order to capture the particle motion when the column collapsing, a high-speed camera and PIV technology (particle image velocimetry) are used to observe the variations in the flow velocity and the flow geometry. The runout deposition is also analysed. Particle size-induced segregation in the flow has also been observed to occur spontaneously during the column collapse. Our results suggest that compositional effects in flows containing more than one particle size may be at least as important as the collapse of granular columns with single size particles. The mechanism of the granular-column-collapse flow with size-bidisperse particles can be well understood according the results in this study.

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