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Simulation of TsaoLing landslide based on Saint Venant Equations over general topography

C. Y. Kuo (1), Y. C. Tai (2), F. Bouchut (3), M. Pelanti (3), R. F. Chen (4), K. J. Chang (5)

(1) Division of Mechanics, Research Center for Applied Sciences, Academia Sinica, Taiwan, (2) Department of Civil Engineering, University of Chi-Nan University, Taiwan, (3) Departement de Mathematique et Applications, Ecole Normale Superieure et CNRS, Paris, France, (4) Institute of Earth Sciences, Academia Sinica, Taiwan, (5) Department of Civil Engineering, National Taipei University

Taiwan is one of the regions on Earth with the highest seismic activity. On the 21st of September, 1999, Chi-Chi earthquake (ML=7.3) struck the central Taiwan at 01:47 local time. This earthquake caused more than 2,450 fatalities and more than 9,000 landslides in the central mountain area of the island.

TsaoLing landslide is the most catastrophic landslide. More than 126 million cubic meters of material ran over a distance of 1.6km with 500m descent in elevation. The deposit caused the fourth formation of the block dam of Chin-Sui River at the foothill of the slope in the local landslide history.

The theoretical model is developed by transforming and depth-integrating mass and momentum balance laws written in a general terrain-following coordinate system. A computation domain of 3,692m x 2795m is setup and discretized into 284 x 215 rectangular cells. The topography data are taken from aerial photographs in 1989 and 2000.

From the simulation, we conclude that the landslide roughly takes 2min. This agrees well with the estimation of local survivors. At such time scale, the maximum landsliding velocity reaches about 90m/s. The best fit of the basal friction angle is 6 degree. Since the strength of the landslide material varies dramatically from 3 to 30 degree

depending on the water content, this fitted friction angle is considered reasonable.