



## **Fragmentation and Deposition of Rock Mass with Joint Strength during Rockfall**

Ming-Lang Lin (1), Chia-Ming Lo (2), Tsun-Kai Lien (1), and Wei-Che Lu (1)

(1) National Taiwan University, Department of Civil Engineering, Taipei, Taiwan (mlin@ntu.edu.tw, +886-2-23649254), (2) Geotechnical Engineering Research Center, Sinotech Engineering Consultants, INC., Taiwan

The fragmentation of rock mass with joint strength and its influence on the deposition during rockfall is important for rockfall hazard evaluation. Different degree of damage within rock shed had been observed in two cases located at the Central Cross Highway of Taiwan.

Small scale laboratory rock-fall experiments were performed to investigate the rockfall process of rock mass with joint strength. Then distinct element method (PFC3D) was used to simulate the fragmentation and deposition process. In addition to the details of the fragmentation and interaction of blocks, energy transformation and dissipation can be discussed in the numerical simulation. When the numerical simulation tool was validated, it was applied to the in-situ Tzau-An Cliff rock-fall case with minor damage of the shed due to fragmentation before the rock blocks impaction.

The laboratory rockfall tests revealed that the joint strength has a negative trend with the run-out distance. In addition, when increase the volume of rock-fall, the run-out distance after fragmentation will increase and the volume of mass which near the toe will increase too. We found the range of deposits display different size for rock mass with different joint strength, and the run-out distance which impact on 45 degrees slope below first is more broken and run-out farther than the one which impact directly on the ground level.

Key word: rockfall, rock mass with joint strength, fragmentation, rockfall test, distinct element method, PFC3D