Dynamic Stress Transfer in a Layered Granular Slope

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In this series of experimental and numerical study using the technique of dynamic photoelasticity and the open source ESyS-Particle code (Uenishi and Goji, *Procedia Struct. Integr.*, 2018; Uenishi and Xi, *SSJ Fall Meeting*, 2021, *Procedia Struct. Integr.*, 2022), in order to clarify the generation mechanism of earthquake-induced slope failures that may involve large deformation, the basic dynamics of dry granular media under impact loading has been observed. In particular, with high-speed video cameras, dynamic stress transfer and particle motion have been traced inside two-dimensional model slopes that consist of penny-shaped birefringent particles prepared by a digitally controlled laser cutter. The granular slopes, standing on a rigid horizontal plane and having different inclination angles, have been subjected to dynamic impact on their top horizontal free surfaces. First, for the slopes without confining retaining walls, two distinct failure patterns, complete collapse or mass flow caused by unidirectional stress transfer and separation of the slope face (toppling) due to multi-dimensionally expanding waves, have been identified (Uenishi and Goji, *Procedia Struct. Integr.*, 2018). Then, in order to clarify the effect of static confinement on the dynamics of granular slopes under impact, additional solid plates have been set on some boundaries of the slopes. For these statically confined slopes, it has been found that dynamic stress transfer and particle motion are considerably governed by the additional solid boundaries resembling retaining walls, and buckling-like jump of particles owing to the presence of the confining retaining walls has been recognized (Uenishi and Xi, *Procedia Struct. Integr.*, 2022).

Here, furthermore, the effect of material heterogeneities on granular dynamics is considered. For this purpose, a (roughly) horizontal interface is introduced in the model. The interface is located between a top layer of smaller particles and a basement made of larger particles, or vice versa. Dynamic stress transfer and particle motion, with special attention to the mechanical behavior around interfaces, are observed for these dissimilar granular slopes with / without retaining walls.

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