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# SIMULATIONS OF MULTI-STAGE FAILURE PHENOMENA IN SLOPE DISASTERS

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The main thrust in this presentation is the exploration of numerical methods for failure simulations of slope disasters involving multiple stages. For example, when we are concerned with slopes with brittle materials and structures, the failure phenomenon must involve the following three stages:

- At the first stage: a structure deforms in response to dynamic or static excitations and displays cracks along prescribed discontinuities so that it would be separated into several blocks.
- At the second stage: several sets of blocks lose static equilibria and start to move dynamically.
- At the third stage: moving blocks collide each other with friction and some of them further break up due to the shock generated by the collision.

To simulate the three-stage failure process involving large deformation and rotations with dynamic frictional-contact behavior, we have developed a new numerical method based on the co-rotational finite element formulation [1]. Also, another new solid-liquid coupled material point method [2] have been developed to predict a collapse process of ground structures such as slopes and embankments subjected to excess pore pressure during a heavy rainfall, which involves a transition process from a soil structure to flowing mixture. The implementations of these separate numerical methods are verified by conducting some numerical tests with a simple structure containing a potential discontinuity. Also, several numerical examples are presented to demonstrate their capabilities and performances in simulating multi-stage failure phenomena in slope disasters.

## REFERENCES

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