MPM simulation of a scaled laboratory slope failure

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ABSTRACT

Simulation of real cases is always an interesting way to validate numerical codes and evaluate their capabilities and limitations. Often, the dimensions and uncertainties of field real cases make it difficult their simulation. On the contrary, controlled laboratory scaled tests offer a good alternative to be simulated at a reduced computational cost allowing code validation.

A laboratory program simulating landslides is currently under development. The landslide movement is recorded and processed using PIV technique [1]. From captured digital images, the movement of a fine mesh is measured to a high precision. The resulting displacement vectors can be converted into strains.

In a preliminary laboratory test, a homogeneous slope of sand was made unstable by means of the inclination of the box base. The test has been simulated using a MPM code. Numerical results and laboratory measurements are compared. The onset of the failure and the evolution of the movement are discussed. A sensitivity analysis on some constitutive parameters and on discretization details is also presented.

Numerical results show a strong dependence of the failure geometry on the strength parameters. Different combinations of cohesion, friction angle and dilatancy lead to failures occurring at the same time of the one observed in the laboratory but with significant different geometries and consequently involving different run-out.

Time and spatial discretization, varying the number of nodes and the number of particles per element, affect the magnitude of the calculated displacement and also the geometry of the failure.

REFERENCES

[1] White. D. J., Take, W. A. & Bolton, M. D. (2003). Soil deformation measurement using particle image velocimetry (PIV) and photogrammetry. Géotechnique 57 (7), 619-631