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THE MATERIAL POINT METHOD FOR THE COLLAPSE SIMULATION OF THE GRANULAR ACCUMULATED STRUCTURE

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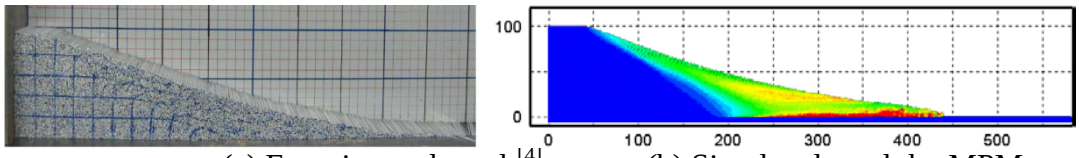
ABSTRACT

The collapse of the granular accumulated structure involves the granular flow and the slope surface movement. Due to mesh distortion, the classic finite element method suffers from the difficulties to treat this collapse problem.

The material point method (MPM) [1, 2, 3] is an extension of the particle-in-cell (PIC) method. MPM is applied to the solid dynamic problems by updating the stress in material points rather than in grid, so that the history dependent material can be modelled conveniently. Being a fully Lagrangian particle method, MPM discretizes a material domain using a set of material points, which are also called particles. The particles carry all state variables such as displacement, stress, strain and temperature. The momentum equations are solved on a predefined regular background grid, so that the grid distortion and entanglement are completely avoided. MPM possesses the advantages of both Lagrangian method and Eulerian method, and can be taken as an efficient tool to treat extensively large deformation problems.

Based on the Drucker-Prager elastic-plastic constitutive model, the collapse problem of the granular accumulated structure is solved using the material point method. For the granular accumulated structure, the final geometry configuration of simulation is in good agreement with experimental result, as shown in Fig.1.



(a) Experimental result[4] (b) Simulated result by MPM

Fig.1 The final configuration of accumulated structure collapse

The computed and experimental results show the reposed angle of the granular accumulated structure is smaller than the internal frictional angle of granular material.

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