A Visco-Rigid Model using PFEM for simulating the Failure of Non-cohesive Granular Material

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ABSTRACT

The aim of the present work is the simulation of the structural response and deformation of a granular non-cohesive slope subjected to the dynamic effect of water.

Rockfill is treated as a non-Newtonian material using a visco-rigid model. This particular constitutive law is chosen among others, mainly because the tracking of the material yield surface is not necessary in the treated problem. When effective stress is zero a radical reduction of viscosity takes place and it is afterwards non linearly controlled by the rate of deformation. On the other hand the yield stress is pressure dependent. The stress-deformation relation is treated using a regularized exponential model that allows avoiding the instabilities caused by the classical bilinear approach. The particle finite element method (PFEM) is the numerical technique employed. Its Lagrangian kinematical approach, with a fast remeshing algorithm allows a natural treatment of large deformations of the shape of the domain [1].

The PFEM-non-Newtonian model is finally coupled with a level set CFD model that allows treating the transitory water evolution inside and outside the granular material.

The characterization of the failure process is dealt with by comparing the numerical models with experimental tests of different sizes and scales [2, 3]. The algorithm is completely developed in *Kratos multi-physics* open source code [4].

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