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Coupled Effects of Energy Dissipation and TravellingVelocity in the Run-Out Simulation of High-SpeedGranular

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ABSTRACT

The run-out of high speed granular masses or avalanches along mountain streams, till their arrest, is analytically modeled. The power balance of a sliding granular mass along two planar sliding surfaces is written by taking into account the mass volume, the slopes of the surfaces, the fluid pressure and the energy dissipation. Dissipation is due to collisions and displacements, both localized within a layer at the base of the mass. The run-out, the transition from the first to the second sliding surface and the final run-up of the mass are described by Ordinary Differential Equations (ODEs), solved in closed form (particular cases) or by means of numerical procedures (general case). The proposed solutions allow to predict the run-up length and the speed evolution of the sliding mass as a function of the involved geometrical, physical and mechanical parameters as well as of the simplified rheological laws assumed to express the energy dissipation effects. The corresponding solutions obtained according to the Mohr-Coulomb or Voellmy resistance laws onto the sliding surfaces are recovered as particular cases. The run-out length of a documented case is finally back analysed through the proposed model.

KEYWORDS

Sliding Granular Mass, Granular Temperature, Shear Layer, Excess Interstitial Pressure

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