

Modeling of Granular Flows with Applications to Collapse of a Granular Column

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Abstract

Granular flows occur in various problems related to geophysical hazards, such as avalanches, landslides, and debris flows. Several studies have been devoted to develop models for granular materials using continuum description. However, granular flows have many states and most of existing models are applicable only to specific states. A new model applicable to all states is developed by decomposing the shear stress and pressure into enduring-contact and kinetic components. A new numerical scheme is proposed, which can avoid numerical instability caused by large volume fractions. To demonstrate its capability, the present model is applied to simulate the collapse of a granular column with various aspect ratios. The evolution of the column shape, the flow field, the final height, and the run-out predicted by the present model agree well with those provided by discrete element methods and experiments.