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Estimating impact force of granular avalanche on obstacles by DEM

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The paper presents a DEM model which allows the simulation of dry granular avalanche flow down incline. It allows the simulation of the flow pattern and computation of impact forces on rigid obstacles. The model is compared with experimental data in literature. The experiments include granular flow along an inclined channel and three-dimensional free surface flow along an inclined cute merging into a horizontal run-out region. The introduction of the constraint of particle rotation allows realistic description of the flow behavior. The influence of the model parameters on granular flow is studied, e.g. the run-out distance, deposition pattern, flow pattern and impact forces against obstacle.

The three-dimensional DEM is an appropriate tool for modeling granular flows and their interactions with obstacles. Due to the fully three-dimensional approach it is possible to calculate the impact forces with these simulation techniques. It is shown that the model performance is strongly dependent on the rotation control. Without any rotation constraint the flow behavior of rough and angular granules cannot be described by DEM correctly. The comparison of impact forces and flow patterns with laboratory experiments shows the potential of DEM for a wide range of laboratory setups.