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Continuum modelling of granular flows

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The continuum modelling of transient granular flows is of primary importance in the context of predicting the behaviour of many natural systems involving granular matter. In this perspective, the granular column collapse experiment provides an interesting benchmark due to its challenging complexity (Lajeunesse et al 2004, Lube et al 2004), and form a trying test for candidate rheological models. In this contribution, we present 2D continuum simulations of granular column collapse using Navier-Stokes solver Gerris (Popinet 2003). The rheology implemented to model the granular media is the so-called $\mu(I)$-rheology, relating the frictional properties and the viscosity of the material to the pressure and shear rate. In addition, discrete simulations using the Contact Dynamics method are performed for systematic comparison between the granular flow dynamics and its continuum counterpart (Staron & Hinch 2005). We find a good agreement, recovering the shape of the flow in the course of time as well as experimental scaling laws for the run-out. A systematic underestimation of the latter is nevertheless observed, and discussed in terms of physical and numerical modeling.

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