Modelling avalanche protection systems by Savage-Hutter theory

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Avalanches and other flow like natural catastrophes like mudflows and landslides caused important damage in the past. Settlements and important infrastructure, like streets or power plants have to be protected, which often demands major effort. The building of protection system is often very expensive, due to the difficult terrain where the constructions have to be placed. Optimizing the size and the positioning of groups of obstacles, relative to each other, in respect to efficiency and costs, is therefore of scientific and economical interest.

In the last decades various models have been proposed. The Savage-Hutter theory is an attractive approach to simulate gravity driven free-surface flows. The model was extended to simulate avalanches in arbitrary topography, where a curvilinear coordinate system was used to create a generally twisted reference surface. Moreover, an elevation function was introduced, which accounts for the difference between the basal topography and its reference surface. In this way, local irregularities could be taken into consideration. This elevation function was also used to include obstacles for avalanche protection into the model. This method has some major weakness, causing too light impact of the obstacles in the model, when compared to laboratory experiments. In this work, the problem will be discussed in detail and an alternative approach will be proposed. Different kind of obstructions will be compared. Also computational results for groups of objects will be presented.