Geophysical Research Abstracts
Vol. 19, EGU2017-14508, 2017
EGU General Assembly 2017

A finite area scheme for shallow granular flows on three-dimensional surfaces

Matthias Rauter (1,2)

(1) University of Innsbruck, Institute of Infrastructure, Division of Geotechnical and Tunnel Engineering, (2) Department of Natural Hazards, Austrian Research Centre for Forests (BFW), Innsbruck, Austria

Shallow granular flow models have become a popular tool for the estimation of natural hazards, such as landslides, debris flows and avalanches. The shallowness of the flow allows to reduce the three-dimensional governing equations to a quasi two-dimensional system. Three-dimensional flow fields are replaced by their depth-integrated two-dimensional counterparts, which yields a robust and fast method [1].

A solution for a simple shallow granular flow model, based on the so-called finite area method [3] is presented. The finite area method is an adaption of the finite volume method [4] to two-dimensional curved surfaces in three-dimensional space. This method handles the three dimensional basal topography in a simple way, making the model suitable for arbitrary (but mildly curved) topography, such as natural terrain.

Furthermore, the implementation into the open source software OpenFOAM [4] is shown. OpenFOAM is a popular computational fluid dynamics application, designed so that the top-level code mimics the mathematical governing equations. This makes the code easy to read and extendable to more sophisticated models. Finally, some hints on how to get started with the code and how to extend the basic model will be given.

I gratefully acknowledge the financial support by the OEAW project ”beyond dense flow avalanches”.

References

[1] SAVAGE, S. B. & HUTTER, K. 1989 The motion of a finite mass of granular material down a rough incline. Journal of Fluid Mechanics 199, 177–215.

[2] FERZIGER, J. & PERIC, M. 2002 *Computational methods for fluid dynamics*, 3rd edn. Springer.

[3] TUKOVIĆ, Ž. & JASAK, H. 2012 A moving mesh finite volume interface tracking method for surface tension dominated interfacial fluid flow. Computers & fluids 55, 70–84.

[4] WELLER, H. G., TABOR, G., JASAK, H. & FUREBY, C. 1998 A tensorial approach to computational continuum mechanics using object-oriented techniques. Computers in physics 12 (6), 620–631.