Granular Flows: Modelling and Computational Challenges

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Key words: Granular flows, Computational Fluid Dynamics, Transport Phenomena.

Granular flows are ubiquitous in many fields such as industrial processing, mining, energy production, food powders, biology, geoscience, or mechanical and civil engineering. The analysis and prediction of these flows is challenging, as they often occur in complex geometries and their rheology can be influenced by many microscopic and macroscopic parameters. Different computational approaches exist:

Discrete particle methods (DPMs) are a powerful computational tool to simulate the movement of many individual particles with complex interactions, arbitrary shapes, in arbitrary geometries. Elaborate interactions like sintering, breaking and agglomeration of particles can be captured through contact models, and the method can be coupled to a continuum solver to solve multiscale phenomena and particle-fluid interactions. However, it is computationally expensive and not able to deal with the vast number of particles involved in full-scale industrial or environmental situations.

Continuum methods can simulate the volume of real industrial flows, but have to make averaging approximations and require physical modelling, often inspired by DPM results. Once these averaged parameters have been tuned via experimental data, these models can be surprisingly accurate. However, existing models are of limited applicability, and consensus on a general continuum model for granular flows has not yet been reached.

This mini-symposium aims to provide an opportunity for physicists, engineers, applied mathematicians and computational scientists to discuss the latest advancements in modelling and numerical methods for predicting granular flows. The focus will be on new rheological models, computational methods, improved algorithms and the modeling of interesting industrial and academic applications. Submissions can include, but are not limited to the following aspects: capturing shape and surface properties of grains; erosion and deposition; segregation; sintering; fluid-particle interaction; cohesive grains; (non-local) continuum theories; applications; and benchmark problems for the community.