Parametrization and validation of a nonsmooth discrete element method for simulating flows of mineral ore balls

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ABSTRACT

Numerical simulation of granular materials is an important tool both for advancing the fundamental understanding of many natural phenomena in material science, statistical physics and geophysics, and for the design, control and optimization of systems for processing, manufacturing, storage and transportation of granular materials, e.g., grains, minerals, pharmaceuticals pills, pellets, sand and rocks. In the mineral process industry, experiments and *in situ* measurements are many times prohibited for practical and economical reasons, and in these cases, modeling and simulation play a critical role in finding ways for radical improvement of the processes. Parametrisation and validation are essential for making sure that the simulated system is representative for the real system.

We use simulation of large-scale granular matter flow based on the nonsmooth DEM [1-2] for exploring the design space of balling drum outlets [3] used in mineral ore pelletization [4]. We present procedure and results for parametrization of the microscopic properties and validation of macroscopic flows by comparing the numerical simulations with camera based measurements of detailed iron ore ball dynamics and of large-scale flow behaviour. The microscopic properties include particle elasticity, restitution coefficient, contact friction and rolling friction – which are parametrized in the constraint based models using the semi-smooth DEM in Ref. [1]. The sensitivity of the flow characteristics with respect to change in the microscopic parameters is also investigated. The measurements of particle flow are made using a high-speed high-resolution camera with maximum frame rate 1,600 fps at maximum resolution 1280 x 800.

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