A methodology of a sensitivity analysis in DEM experiments

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ABSTRACT

The Discrete Element Method (DEM) is an appropriate method to investigate the behavior of granular media for instance sandy soil, powder or bulk media. This method is often used in the investigation of the tire-soil interaction, tillage tools, the flow of particles on chutes or hoppers. In DEM a granular medium is treated as an assembly of particles which could move independently of each other corresponding to Newton’s second law. A very important and crucial point is the identification of the DEM-parameters. Since the fitting of contact-model parameters with measurement of single particle properties isn’t useful and not possible at all, the common way is the validation of numerical results with experiments. This process is a challenging task, which often is performed with a trial and error procedure [1]. In this talk the methodology of a sensitivity analysis is shown. This method allows the determination of the most significant DEM-parameters. With this knowledge a more purposive calibration is possible. In some experiments parameters may occur which have no influence in the calibration process thus they can be neglected.

A common used experiment for the calibration is the simulation of a pile [1, 2]. The angle of repose could be used to determine the compliance between the numerical heap and the experimental one. An algorithm is described to determine this angle from the three dimensional heap of spheres. On this basis a Design of experiments (DOE) with the Latin hypercube sampling was generated [1]. With this data points a metamodel was fitted and a sensitivity analysis based on Sobol’s Indices [3] was performed to identify the influence of the DEM-parameters on the angle of repose.

In the same way the oedometer experiment [4], which is a one dimensional compression experiment, is investigated and Sobol’s Indices are identified.

The investigation shows that for the chosen contact and rolling-friction-model for the heap and the oedometer experiment some parameters have a negligibly small influence.

REFERENCES