



Experimental assessment of ceramzite particle characteristics for DEM simulation

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Introduction:

- The aim of this work is to find a suitable but simple model that will describe the phenomena in the rotary kiln.
- The paper deals with the description of a simple hopper experiment and the analysis of the obtained data.
- The stand consists of transparent side walls, examined sliding surfaces, a discharge mechanism and control system.
- The change in weight as a function of time and the shape of the material level in the hopper are recorded for comparison with simulations. The parameters obtained by fitting the experimental data with model will be used for subsequent numerical simulations of the rotary kiln.

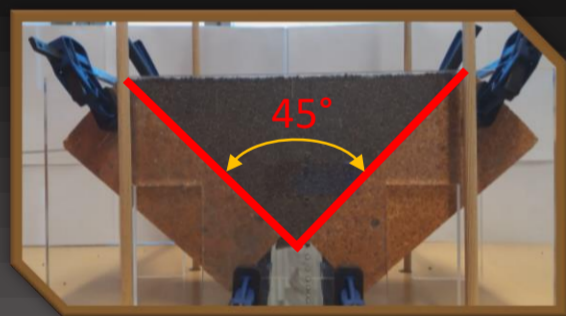
Experimental setup:

Hopper stand: sliding material – refractory concrete bricks, fastened between two plexiglass plates using quick-release clamps. Weight sensor Omega Engineering LCM101-10, AD converter Janascard AD24, constant voltage source Manson SDP2405. Material discharge are recorded by a weight sensor and camera.

Liapor 2-4/450 material was used for experiments. The fraction is declared 2 – 4 [mm]. Bulk density 450 [kg/m^3] with tolerance of $\pm 15\%$. The bulk density of the grain is 850 [kg/m^3] with tolerance of $\pm 15\%$.

The experiments were performed for 10 hopper slopes (10°, 20°, 30°, 45°, 50°, 55°, 60°, 65°, 70° and 75°) and each experiment was repeated for a given configuration 10 times.

Hopper slope configuration 45°:



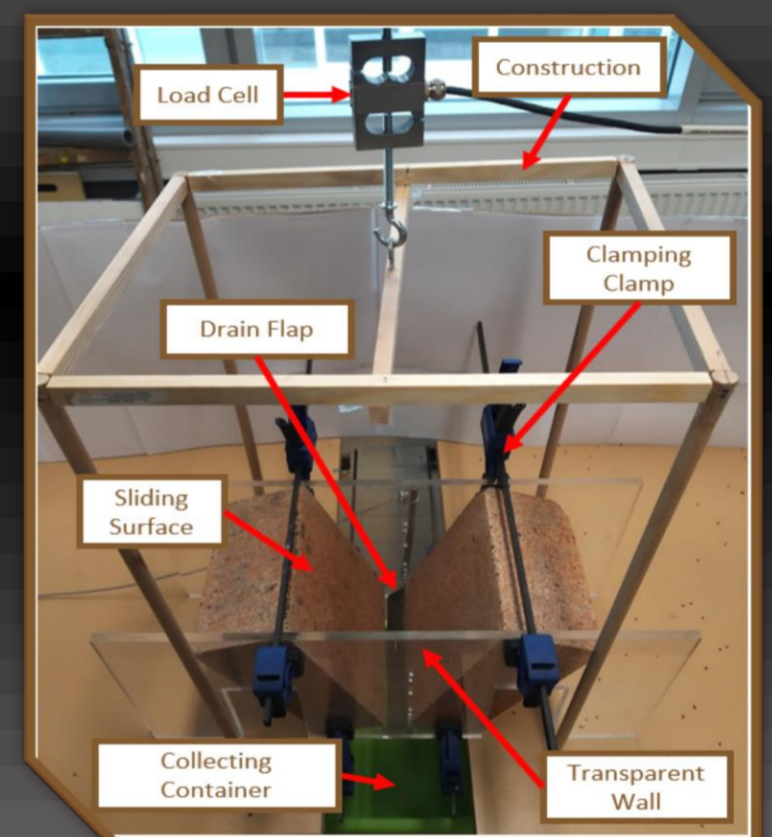
t = 0 sec



t = 2 sec



t = 4 sec



Evaluation:

Measured data were evaluated with use of python programming language and supported libraries. A subprogram of variables entered the evaluation file, where time shifts in individual measurements were set manually. Evaluation program is suitable for evaluation of data sets, for example .xls, .csv formats. A subroutine for creating a curve growth video is created in the same program.

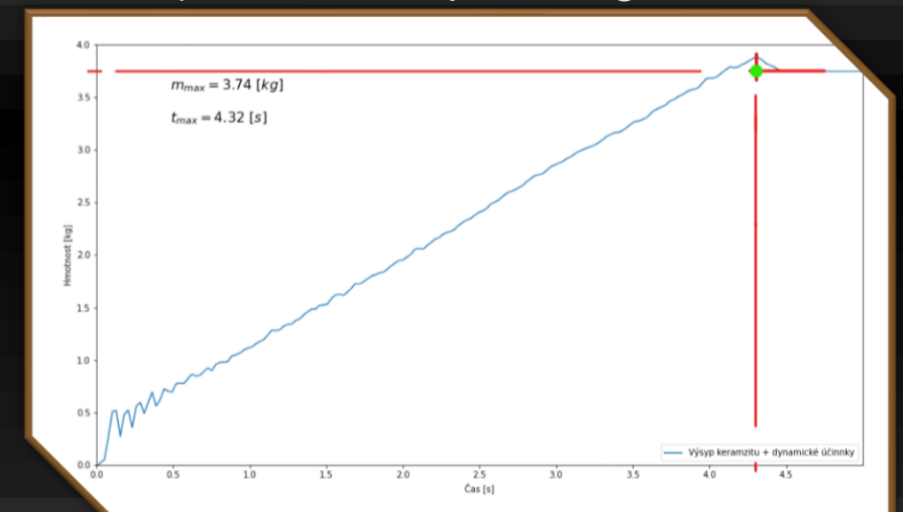
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Python script showing code for data evaluation and visualization.
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Conclusion:

The result of the experiment is shown as the time of dumping of expanded clay from the hopper (with a specific configuration and materials of sliding surfaces) on the dumped weight.

Dump weight:
3,74 [kg] (100%)

Dump time:
4,32 [s]



Configuration 45°, measurement No.1, ceramzit 2-3 [mm], refractory concrete bricks

Acknowledgement:

The work presented here was supported by the Grant Agency of the Czech Technical University in Prague under grant number SGS18/129/OHK2/2T/12.