

Fraunhofer

FlowBoard: Reliable Calibration of Simulation Models for Granular Materials

Figure 1: FlowBoard laboratory setup.
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Laboratory setup for characterizing bulk materials and for determining material-specific simulation parameters using 3D printed obstacle courses

Reliable discrete element method (DEM) simulations require accurately calibrated model parameters. At the Fraunhofer Institute for Mechanics of Materials IWM, we combine experimental powder-flow characterization with numerical simulations using our patented FlowBoard to determine suitable model parameters for granular materials.Reliable discrete element method (DEM) simulations require accurately calibrated model parameters. At the Fraunhofer Institute for Mechanics of Materials IWM, we combine experimental powder flow characterization with numerical simulations using our patent-pending FlowBoard to determine suitable model parameters for granular materials.

The FlowBoard enables the simultaneous characterization of multiple aspects of powder flow using a patented obstacle course. By capturing characteristic flow behavior in a single experimental setup, it provides an efficient basis for calibrating DEM model parameters.

Together with our customers, we identify suitable modeling assumptions based on the powder properties and intended application. We then characterize the powder experimentally and use automated image analysis to extract characteristic quantities. While some parameters can be derived directly from measurements, others are determined through inverse simulation by matching simulated and experimentally observed powder flow.

At Fraunhofer IWM, we have more than 20 years of experience in modeling and simulating granular materials. In addition to our in-house simulation software SimPARTIX®, we offer model parameter calibration for other DEM simulation tools, providing flexibility and independence from specific software solutions. Our customers receive application-specific model parameters, recommendations on suitable modeling assumptions, a report summarizing the results, and an assessment of parameter sensitivity.

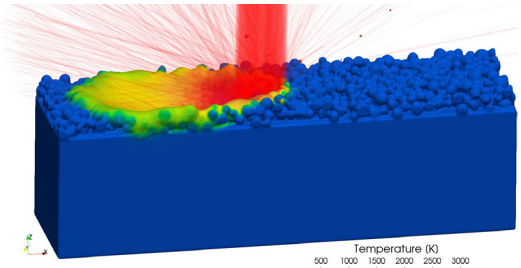


Figure 2: LPBF simulation using SimPARTIX



Figure 3: Complete characterization of the powder flow through an obstacle course. © Kai-Uwe Wudtke , Fraunhofer IWM

This provides a reliable basis for using numerical simulations to improve process understanding and support targeted process optimization. The FlowBoard enables the simultaneous characterization of multiple aspects of powder flow using a 3D printed obstacle course. By capturing characteristic flow behavior in a single experimental setup, it provides an efficient basis for calibrating DEM model parameters.

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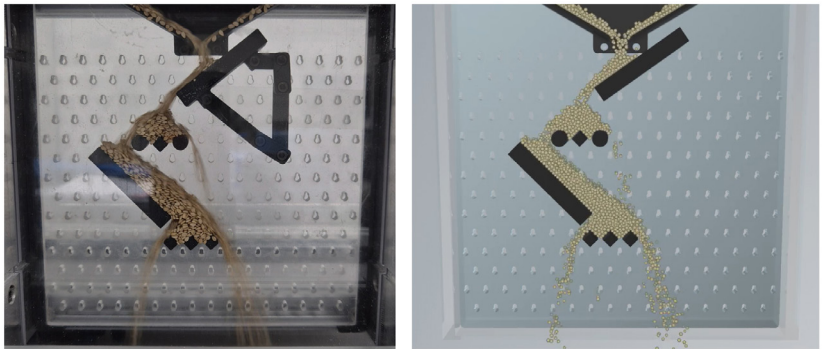


Figure 4: Exemplary FlowBoard analysis. Experiment (left); Simulation (right). © Fraunhofer IWM

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exhibit overview