

The Next-Generation of Powder and Particle Characterisation Tools

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Discrete element method (DEM) is a way of simulating powders on a computer where each particle is modelled as an individual element. DEM can be used to simulate powders in industrial equipment to design better equipment. However, to get good results the microscopic properties of the powder - friction, cohesion – need to be calibrated to ensure the simulation provides accurate results. Current calibration are time-intensive and often inaccurate. Therefore, a better calibration method is needed. Powder characterisation tools are lab scale pieces of equipment that take a sample of powder or granular material and measure a bulk property. A simple example is pouring a powder on a table to form a heap. The angle this heap makes with the surface is a common measurement used for powders called the angle of repose. These bulk measurements are inherently linked to the microscopic properties. If the particles that make up a powder are more frictional, then the heap will be steeper, and the angle of repose measured will be higher. Therefore, if we knew the relationship between each bulk measurement of a powder and the microscopic properties of the particles, the bulk measurements could be used to calculate what the microscopic properties could be. Unfortunately, this relationship is very complex and currently impossible to find. Instead, a data driven approach is being used. Digital twins of powder characterisation tools, as can be seen in the top half of Figure 1, are being used to generate data of bulk measurements at different microscopic properties on BlueBear. This data can then be used with a data-driven method to calibrate DEM simulations in any system.

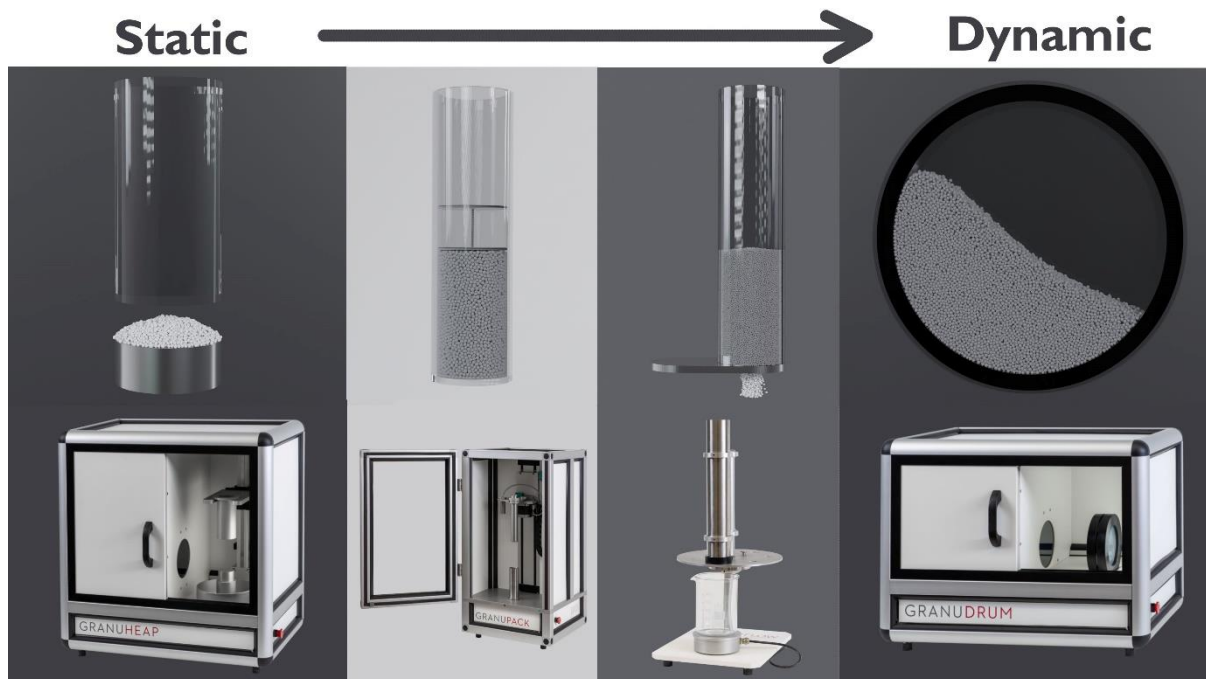


Figure 1: Top digital twins, bottom real instruments. From left to right: GranuHeap, GranuPack, GranuFlow and GranuDrum. The dynamics of the tool increases from left to right.