96st MSS-Seminar
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Nägelsbachstr. 49b

MSS

Understanding the Role of Particle Shape in Determining the Stability, Flowability and Internal Structure of Granular Materials

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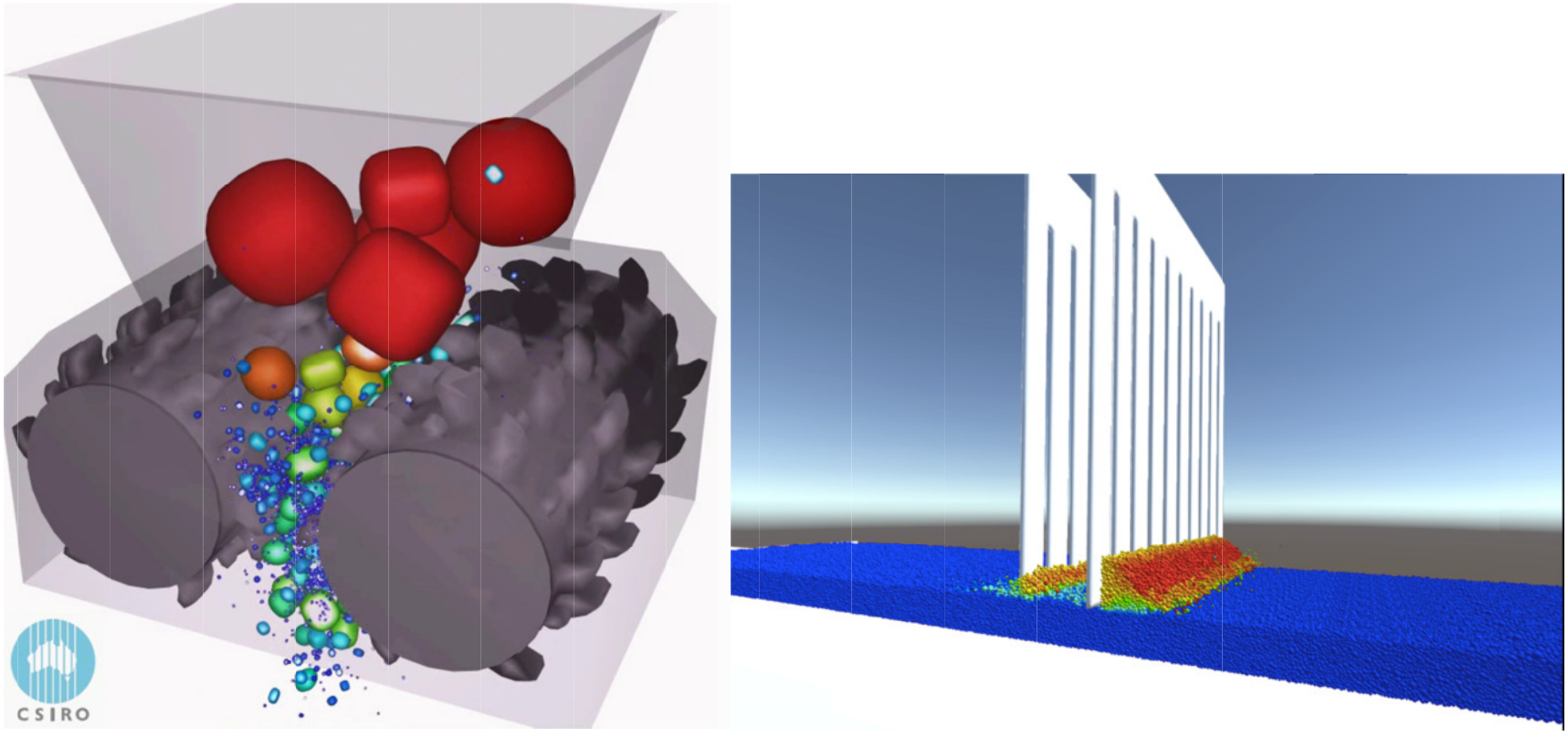

Figure 1: (left) DEM simulation of crushing of coal in a double roll crusher. (right) Simulation of the addition of a layer of metal powder via raking in a 3D printing device.

The Discrete Element Method (DEM) is a powerful computational tool that can be applied to better understand the fundamentals of granular systems, their structure and their complex behaviours during flow. Here particle shape is a critical determining factor and we explore its role via an extensive set of DEM simulations that cover industrially important use cases including: raking of Titanium powder in 3D printing applications, landslide runout due to collapse of a granular pile, and particle breakage in industrial crushing devices [4]. We demonstrate how the bulk structural properties in a granular system can be manipulated by varying the shapes [1-3], surface properties and mixture ratios of the grains, making it possible to generate systems with desired and tunable properties. This can include packing density, flowability, energy dissipation, stability and resistance to shear. These properties can then be exploited in a multitude of ways from breaking material efficiently (using lower energies to generate finer product) to optimising the density variation and surface smoothness of systems during shear. An example of the application of this approach to optimising the structure of Titanium powder beds used in 3D printing and how this can improve the quality of the final 3D printed part will be discussed (Figure 1).