Dynamic image analysis for three-dimensional particle shape characterization

Iain Brown, Sadegh Nadimi,
School of Engineering, Newcastle University, United Kingdom;
Vasileios Angelidakis,
School of Engineering, Newcastle University, United Kingdom,
Institute for Multiscale Simulation, Friedrich-Alexander-Universität Erlangen- Nürnberg, Germany

Particulate matter is ubiquitous in numerous industries, from energy storage to medicine, with many industrial processes being increasingly dependent on understanding particulate matter on a finer scale. As real particles have such a large variation in morphology, it is crucial to characterise them at scale, accurately, and in real-time. Current industrial standards are limited to 2D analysis of dynamic particulates or 3D analysis of static particulates, using technologies such as digital microscopy or X-ray CT scanner, respectively. The combination of several 2D images projected from different perspectives allows for 3D reconstruction and 3D characterisation of particle morphology. A real-time shape analysis is performed to classify particles with a higher degree of accuracy. Via use of these projections, several camera orientations have been set up in order to find the orientation of perspectives that provides the highest degree of accuracy with the lowest cost in creating 3D avatars of particles. In order to show the benefits of 3D analysis over 2D analysis, irregular particles of dolomite, silica sand, and waste glass beads are tested and compared with X-ray CT images. This study allows for a broad range of different morphological indices to be investigated and for the level of characterisation error to be quantified.

KEYWORDS

Particle Characterisation; Particle Shape; 3D Image Analysis