Continuum-Based Analysis of DEM Simulations for Industrial Processes

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ABSTRACT

Discrete Element Method (DEM) has become the most powerful tool to simulate different processes and handling operations of powders and particulate solids. Nevertheless, its use for real industrial problems requires significant computational resources and generates a large amount of data, resulting in a significant challenge to deliver visualisation and analysis of the results. Most DEM software has focused on reducing the computational cost and increasing the complexity of the simulations, but they present a lack of versatility in the preparation of the simulations and the extraction of meaningful engineering information for the analysis of the particle-based data. This has been a significant impediment to the adoption of DEM in industry, in comparison to simulation technologies used in other areas, such as FEA or CFD, where the simulation-based design is a standard tool for engineers.

This paper presents the advances in the use of spatial-temporal averaging techniques to transform the particle-based data from DEM simulations to bulk quantitates onto a continuum field, extending the analysis capabilities of this type of simulations considerably and reducing at the same time the large amount of data stored.
The technique is applied to different real-scale problems for the analysis of common phenomena as mixing, segregation or heat transfer, where the continuum-based (bulk) quantities are used to compare scenarios by adapting variables as mixing quality index or concentration and developing new performance indices for more complex processes.

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