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EDITORIAL

Editorial foreword to the Special Issue of Journal of Computational Particle Mechanics "Particle modeling of powder-based processes in advanced manufacturing"

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Particle-based methods, including Discrete Element Method (DEM), Particle Finite Element Method (PFEM), Molecular Dynamics (MD), Smoothed Particle Hydrodynamics (SPH), and others, have gained enormous popularity in the recent years as simulation tools for scientific investigation as well as engineering analyses. These methods provide a powerful framework for modelling different natural and novel man-made materials at different scales ranging from the atomistic through micro- and meso- to macroscopic ones. Their applications include many sectors such as civil engineering, mining, chemical industry, material science, agriculture, pharmaceutical industry, and many others.

The aim of this special issue has been to aggregate the most current developments and advances in modelling and simulation of powder-based processes using numerical methods employing particle models. Application of these methods to modelling of manufacturing processes appears to be relatively less known in comparison with other fields. Generally speaking, the works on particle modelling of powder-based processes in manufacturing are dispersed over many journals in material science and numerical methods.

The special issue contains the following articles:

1. A DEM contact-model for history-dependent powder flows.
2. Micro-macro transition and simplified contact models for wet granular materials.
3. Simulating granular materials by energy minimization.
4. The effect of particle shape on mixing in a high shear mixer.
5. Coupled discrete element and smoothed particle hydrodynamics simulations of the die filling process.
6. Discrete element simulation of powder compaction in cold uniaxial pressing with low pressure.
7. Validation of DEM modeling of sintering using an in situ X-ray microtomography analysis of the sintering of NaCl powder.
8. Modeling and simulation of the post-impact trajectories of particles in oblique precision shot-peening.
9. Discrete element simulation of charging and mixed layer formation in the ironmaking blast furnace.

The above articles present new developments of theoretical formulations and application of theoretical models to the simulation of practical engineering problems. The applications include different processes related to manufacturing technologies—mixing of granular materials in food and pharmaceutical industries, powder metallurgy, shot-peening, and iron metallurgy. The works presented in the special issue show that the particle-based methods are a powerful tool to model manufacturing processes. We believe that this issue will promote a wider use of particle-based methods in modelling and simulation of manufacturing processes.

On behalf of the editorial team, we would like to thank all the authors for contributing to this special issue and all the reviewers for their help in evaluating the papers.

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