The XDEM Multi-physics and Multi-scale Simulation Platform: Methodology and Engineering Applications

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ABSTRACT

The XDEM multi-physics and multi-scale simulation platform roots in the Extended Discrete Element Method (XDEM) (1; 2) and is being developed at the Institute of Computational Engineering (XDEM research team) at the University of Luxembourg. The platform is an advanced multi- physics simulation technology that combines flexibility and versatility to establish the next generation of multi-physics and multi-scale simulation tools. For this purpose the simulation framework relies on coupling various predictive tools based on both an Eulerian and Lagrangian approach. Eulerian approaches represent the wide field of continuum models while the Lagrange approach is perfectly suited to characterise discrete phases. Thus, continuum models include classical simulation tools such as Computational Fluid Dynamics (CFD) or Finite Element Analysis (FEA) while an extended configuration of the classical Discrete Element Method (DEM) addresses the discrete e.g. particulate phase. Apart from predicting the trajectories of individual particles, XDEM extends the application to estimating the thermodynamic state of each particle by advanced and optimised algorithms. The thermodynamic state may include temperature and species distributions due to chemical reaction and external heat sources. Hence, coupling these extended features with either CFD or FEA opens up a wide range of applications as diverse as pharmaceutical industry e.g. drug production, agriculture food and processing industry, mining, construction and agricultural machinery, metals manufacturing, energy production and systems biology.

REFERENCES

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