EngOpt2018 - 6th International Conference on Engineering Optimization
Instituto Superior Técnico, Lisbon Portugal • 17-19 September, 2018
Editors: H.C. Rodrigues, J. Herskovits, C.M. Mota Soares, et al.

Abstract ID 1031

STUDY OF POWDERS HANDLING WITH DISCRETE ELEMENT METHOD: HOW OPTIMIZATION SHOULD AND CAN BE USED

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Keywords: Discrete Element Method,Calibration,Surrogate Models,Shape Optimization

Abstract: According to current estimations, a large amount of industrial capacity is get lost due to solids handling problems while the energy consumption of solids handling consumes around 10% of the annual global energy utilization. In such a framework, industries are thus looking more and more into computational methods to study bulk materials and design better processes. Thanks to increasing computer capabilities and more readily useable codes, Discrete Element Method (DEM) is nowadays an available tool for industries. Even if DEM can treat also other powders processes like agglomeration and fluidization, the present work focuses on powders handling and how can optimization techniques help in studying this kind of processes through DEM. Optimization is always required to perform a DEM analysis. In fact, due to the lack of powders rheological data and the number of parameters that characterize the particles interaction models, a calibration step is a requisite to achieve significant results from DEM. A methodology based on surrogate models to calibrate DEM using experimental data measured in bulk physical tests is here detailed. It consists in the DEM reproduction of experimental tests and the creation of suitable response surfaces of this virtualization. The proposed approach reduces the calibration to experimental tests and optimization on surrogate models by avoiding DEM simulations in the calibration stage each time a new powder is studied. Optimization can also be part of a DEM based design process of a handling machine. There are few works in literature on shape optimization coupled with DEM mainly due to computational efforts. A coarse-grained approach to perform shape optimization with DEM is also proposed and applied to an industrial component.