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On Performance of Data Models and ML Routines for Simulations of Casting Processes

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Abstract

The performance of data models and their associated machine-learning routines for simulations of multi-physical continuous casting processes are scrutinised in this research work. Data science techniques have already started to have a significant impact on optimisation and controlling of manufacturing processes by providing fast and real-time predictive-corrective tools. These techniques employ data analytics, data training\learning, and deterministic\statistical methods to create fast and real-time models to improve manufacturing processes. In this research work, data reduced models and machine learning (ML) routines are developed to predict the influence of various process parameters on direct chill casting processes. These data models represent the essential features of the multi-physical casting processes, while significantly reducing the simulation time and efforts. Hence, the computational fluid dynamics (CFD) simulations are initially used to create a comprehensive database where variations of major process parameters are considered using carefully-sampled snapshot matrices. These matrices are employed to capture the most important aspects of the processing parameters including melt temperature, cooling and casting speed. Furthermore, the resulting data models are thoroughly examined for their accuracy and reliability using some selected design of experiments (DOEs).

Keywords: data models, real-time modelling, data training, machine learning, direct chill casting, continuous casting process

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