Preface of the guest editors

This issue continues the series of topical issues on Computational Manufacturing and further elaborates recent trends and challenges in this intrinsically multidisciplinary research area at the intersection of computational mechanics, material modelling, materials science, applied mathematics and production engineering. The contributions include the investigation of sintering technologies as introduced in the previous issue and now completed in this issue. Finite-Element-based model validation is elaborated based on the previously documented experimental investigations. The emerging three-field problem includes the coupling of mechanical, thermal, and electrical fields (Rothe et al., Field Assisted Sintering Technology, Part II: Simulation). A key challenge for the design and control of advanced metal forming processes is related to the solution of inverse problems for path-dependent material behaviour. Both the modelling framework and gradient-based solution strategies for inverse problems are discussed in this issue (Landkamer et al., On gradient-based optimisation strategies for inverse problems in metal forming). Representative numerical examples include the identification of inelastic material parameters as well as the determination of optimal, initial workpiece design. The simulation of Computational Manufacturing procedures that involve (very) large deformations and configurational changes, such as cutting processes with the formation of chips and burrs, require advanced computational methods for the robust numerical solution of the emerging boundary value problems. The capabilities and advantages of the Particle Finite Element Method (PFEM) are elaborated and compared to the traditional Finite Element Method (FEM) (Sabel et al., Simulation of Cutting processes by the Particle Finite Element Method). The fourth contribution to this this issue investigates the notion of process signatures in the context of manufacturing processes. To this end, an overview of selected computational approaches capable of resolving basic properties of heterogeneous microstrucures as well as process related boundary and loading conditions are reviewed and exemplarily applied in the context of a cohesive zone model (Rezaei et al., Cohesive zone-based modelling of nano-coating layers for the purpose of establishing process signatures).

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