9th GACM
Colloquium on Computational Mechanics
for Young Scientists from Academia and Industry
September 21 to 23, 2022 in Essen, Germany
gacm German Association for Computational Mechanics

MS 14

Microstructural material modelling and simulation of machining processes

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Machining processes have a remarkable influence on the material properties of the workpiece, especially in the surface layer. The individual processes are characterized by different loads and, in turn, lead to different microstructural changes. Material models for the related complex material behavior as well as methods, which enable a time-efficient simulation of the machining, are a prerequisite for an optimized material preparation and thus a sustainable use of resources in the industry. The minisymposium addresses the latest developments in the research field of process modeling. It focuses on not only mechanical, thermal, and thermo-mechanical processes, such as deep rolling as well as quenching and tempering, but also accounts for multiphysical processes, such as electrochemical machining or induction hardening. Contributions may relate to modeling of microstructural changes due to the processing, e.g., phase transformations, dynamic recrystallization, or the formation of dislocations, as well as their mutual influence. Additionally, the minisymposium deals with single or multiscale methods for efficient process simulations as well as with their experimental validation. An exemplary but not exclusive list of topics is

- simulation of machining processes with thermal, mechanical, electrical, and chemical impact
- macroscopic formulations, multiscale methods (e.g., FE^2, FE-FFT)
- material modeling of microstructural evolutions during machining, for instance, phase transformations, solidification, formation of dislocations, plastic deformation, chemical reactions, damage, etc. and their interactions
- resulting material properties due to a changed microstructure
- coupled problems
- parameter identification, experimental comparison, and validation