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Adaptivity and memory-reduced adjoints for optimization problems with parabolic PDE-constraints

Optimization of engineering processes including heating in time dependent domains

Alfred Schmidt

Zentrum für Technomathematik, Universität Bremen, Germany

schmidt@math.uni-bremen.de

Abstract:
We present two models for engineering processes, where heating of metal workpieces and time dependent domains play an important role. Thus, a parabolic heat equation is coupled with other equations. Challenges for the optimization of such systems are presented.
The first model describes a milling process, where material is removed and heat is produced by the cutting, leading to thermomechanical distortion. An optimization of the cutting path and speed, varying chip thickness and thus heat production, etc., should give reduced distortion during and after the process.
The second model describes the melting and solidification of metal heated by a laser beam, where the microstructure of the re-solidified material depends on the temperature gradients near the moving liquid-solid interface. Accelerating the process on the one hand and improving the microstructure on the other hand compete for an optimized process.