

Distortion compensation - an optimal control approach

in mini-symposium "Stability, Sensitivity and Error Analysis for Optimal Control Problems"

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Abstract:

In mechanical engineering distortion terms undesired alterations of size and shape of a workpiece. Owing to different densities in the respective phase, the heat treatment of multi-phase materials often leads to unavoidable distortion. Here, the remedy is to solve an optimal shape design problem to find the appropriate initial shape prior to heat treatment such that the heat treatment leads to the desired phase distribution as well as to the desired workpiece shape.

If the workpiece has no phase boundaries after heat treatment, the heat treatment itself can be used to compensate distortion, which amounts to the tackling of an optimal control problem.

In the talk I will describe both approaches in the case of steel workpieces. To this end, optimal control problems will be discussed subject to a thermomechanical system of state equations accounting for thermal, elastic and (transformation induced) plastic effects. We will investigate optimality conditions and show some numerical results including an application related to distortion compensation of roller bearing rings.

(Joint work with D. Kern and W. Weiss, WIAS)

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