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MATERIAL PARAMETER IDENTIFICATION USING FINITE ELEMENTS

S. Hartmann[1], R. R. Gilbert[1]

[1] Institute of Applied Mechanics, Clausthal University of Technology, Adolph-Roemer-Str. 2a, 38678 Clausthal-Zellerfeld (Germany), stefan.hartmann@tu-clausthal.de and www.itm.tu-clausthal.de

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ABSTRACT

There exists a variety of experimental data, which is based on inhomogeneous deformations. In such cases, the material parameters of a constitutive model cannot be determined by the reduced material model itself. Thus, the full initial boundary-value problem has to be solved, where we draw on the finite element method. This field has mainly been influenced by Mahnken, see, e.g., [1], but also further researchers contributed to this field, see, for instance [2]. Material parameter identification is, on the other hand, a field of Numerical Mathematics, see, e.g., [3], where further concepts, not known in the Engineering literature, have been published. In this presentation, both directions are compared using the concept of the method of vertical lines. This leads to a system of differential-algebraic equations for constitutive models of evolutionary-type (elastoplasticity, viscoelasticity, viscoplasticity) after the spatial discretization using finite elements [4]. Applying a Backward-Euler method combined with the Multilevel-Newton algorithm, it will be shown how the sensitivities for Gauss-Newton like optimizations schemes have to be computed in a consistent manner. A systematic algorithmic concept and a clear notation provides a general framework for such constitutive models. It will be shown that the concept in Engineering Science are connected to "*simultaneous simulation of sensitivities*" and "*internal numerical differentiation*" in the field of Numerical Mathematics [5]. Moreover, ideas of identifiability are addressed as well.

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