

A framework for variational constitutive updates based on hyper-dual numbers: Application to thermomechanically coupled gradient enhanced plasticity theory

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ABSTRACT

We present a generic framework for thermomechanically coupled plasticity theory based on so-called variational constitutive updates, cf. [1]. Within variational constitutive updates the underlying balance laws and constitutive equations are fulfilled by minimization of an incremental potential and an appropriate parametrization of the evolution equations. The exact first as well as the second derivatives of the incremental potential necessary for a Newton-type iteration are computed by means of hyper-dual numbers, see [2]. By doing so, the laborious task of implementation is highly reduced, which provides the possibility of fast prototyping for a wide range of material models.

As a representative example and in line with [3], a fully thermomechanically coupled and gradient enhanced plasticity model is presented.

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