A MONOLITHIC APPROACH APPLIED TO THERMO-MECHANICALLY AND ELECTRO-THERMO-MECHANICALLY COUPLED PROBLEMS

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The application of the method of vertical lines in the case of quasi-static solid mechanics using inelastic material properties yields after the spatial discretization by means of finite elements a system of differential-algebraic equations (DAE-system). This is the case of thermo-mechanically coupled problems and electro-thermo-mechanical situations as well.

In this presentation the application of high-order time-integration methods and their pitfalls are discussed as well. First, analytical equations are developed to provide verification examples. Second, order investigations are discussed showing that for non-linear Dirichlet-boundary conditions in the heat equation an order reduction phenomenon occurs. This can be circumvented by a proposal of [1], where the boundary-conditions are integrated as well. The applications are small strain thermo-viscoplasticity, finite strain thermo-viscoelasticity using high-order DIRK-methods, see [2], and small strain thermo-electro-mechanics, which occurs in specific problems in field-assisted sintering problems, see [3].

REFERENCES
