On the implementation of variational constitutive updates at finite strains

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Abstract. In this paper an efficient, variationally consistent, algorithmic formulation for rate-independent dissipative solids at finite strain is presented. Focusing on finite strain plasticity theory and adopting the formalism of standard dissipative solids, the considered class of constitutive models can be defined by means of only two potentials being the Helmholtz energy and the yield function (or equivalently, a dissipation functional). More importantly, by assuming associative evolution equations, these potentials allow to recast finite strain plasticity into an equivalent, variationally consistent minimization problem, cf. [1–4]. Based on this physically sound theoretical approach, a novel numerical implementation is discussed. Analogously to the theoretical part, it is variationally consistent, i.e., all unknown variables follow naturally from minimizing the energy of the respective system. Extending previously published works on such methods, the advocated numerical scheme does not rely on any material symmetry regarding the elastic and the plastic response and covers isotropic, kinematic and combined hardening, cf. [5].

References

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