

Materials with Memory: Mathematical Models and Numerical Methods

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The talk deals with inelastic deformation arising in elastoplasticity and in macroscopic approaches to shape memory alloys. In the first part, implicit Runge-Kutta methods for the dual problem of elastoplasticity are analyzed and classified. The choice of Runge-Kutta time integration is inspired by the problem structure, which consists of a coupled system of balance equations and unilaterally constrained evolution equations and which can be viewed as an infinite-dimensional differential-algebraic equation. Focussing on the time axis and leaving the space variables continuous, a grid-independent convergence result is given along with contractivity preservation. The second part considers more general materials and introduces a dynamic iteration scheme to exploit the local structure of the evolution equations. As example, the motion of an artificial finger driven by NiTi wires is simulated.