Materials with Memory: Mathematical Models and Numerical Methods

Prof. Dr. Bernd Simeon
Technische Universität München

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.