Semi-smooth Newton methods for Optimal Control of the Wave Equation

Axel Kröner[1], Karl Kunisch[2], Boris Vexler[3]

[1,3] Technische Universität München, Zentrum Mathematik, Boltzmannstr. 3, 85748 Garching b. München, Germany

[2]University of Graz, Institute for Mathematics and Scientific Computing, Heinrichstr. 36, A-8010 Graz, Austria

In this talk we consider numerical methods for solving PDE constrained optimization problems.

We analyze the convergence behavior of semi-smooth Newton methods for optimal control problems governed by the wave equation with pointwise inequality control constraints. These methods can be equivalently reformulated as primal-dual-active set strategies (PDAS).

We concentrate on three different cases: distributed control, Neumann boundary control and Dirichlet boundary control. For distributed control and for Neumann boundary control we prove superlinear convergence of PDAS. For Dirichlet optimal control based on the very weak solution of the wave equation we show, that there is no special smoothing property allowing to prove superlinear convergence. However, when considering a damped wave equation we can prove superlinear convergence.

A discretization based on space-time finite elements is proposed and numerical examples are presented.