Abstract

The purpose of this talk is to revisit the class of parabolic PDE-constrained control problems treated in [Gunzburger, Kunoth 2011]. There, an adaptive algorithm based on wavelets was proposed for the efficient numerical solution of a control problem governed by a linear parabolic evolution equation for which convergence and asymptotically optimal complexity for all components of the solution (state, adjoint state and control) was established. The foundation for this new paradigm was that the partial differential equation (PDE) constraints were written in a full weak space-time form, following the approach for a single parabolic PDE in [Schwab, Stevenson 2009].

Here I wish to address again full weak space-time formulations of the linear parabolic PDE constraints in the context of PDE-constrained control problems. The original formulation in [Dautray, Lions 1992; Schwab, Stevenson 2009], or the variation by [Chegini, Stevenson 2011; Stapel 2011], applying integration by parts with respect to time, lead to a linear operator equation with a nonsymmetric operator which requires more effort than for symmetric operators when it comes to its numerical solution.

One inspiration for this work came from [Fontes 1999; Larsson, Schwab 2015] where time derivatives of order 1/2 were introduced by means of a fractional calculus; thus, requiring less temporal regularity and allowing for a ‘more symmetric’ PDE operator. Another inspiration came from a work by [Langer, Wolfmayr 2013] where a Fourier basis was employed for a time-periodic control problem.

This is joint work with Christian Mollet (Universität zu Köln).