Numerical optimal control for parabolic PDEs using a space-time Finite Element Method

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In this talk, we will present some numerical methods for optimal control of parabolic PDEs. In particular, we aim to minimize certain objective functionals subject to linear/nonlinear parabolic PDEs, under proper constraints on the control variables. We use a space-time finite element method, based on a Galerkin–Petrov variational formulation employing piecewise linear finite elements simultaneously in space and time, to discretize the optimality system, which includes both the state and adjoint state equations. In contrast to the main drawback of conventional time stepping methods, such an approach provides a flexibility to perform local refinements in space and time simultaneously for the coupled optimality system, in which time is considered as another spatial coordinate. On the other hand, it often becomes a bottleneck to efficiently solve the large scale linear/linearized system of equations arising from the space-time finite element discretization, for which we have considered an algebraic multigrid preconditioned GMRES method.

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