A priori and a posteriori error analysis of an algebraic flux correction scheme for an optimal control problem

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In this talk, we consider an optimal control problem on a bounded domain $\Omega \subset \mathbb{R}^2$, governed by a time-dependent convection–diffusion–reaction equation with pointwise control constraints. We adopt the optimize–then–discretize approach, and the resulting optimality conditions yield a coupled system of two time-dependent convection–diffusion–reaction equations.

It is known that convection–diffusion–reaction equations can develop sharp layers, which pose challenges for standard finite element methods. These layers can cause issues such as spurious oscillations, violating physical properties of the solution. To address these issues, we stabilize the fully discrete scheme derived from the optimality conditions by employing the algebraic flux correction method. The resulting fully discrete scheme based on the backward Euler is nonlinear, and we discuss its well-posedness as well as we derive error estimates. Additionally, we derive a residual-type a posteriori error estimator.

Finally, we provide numerical experiments that validate the theoretical results.

References:

[1] https://arxiv.org/pdf/2412.21070

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