Stabilized Finite Element Solutions to the Advection-Dominated Optimal Control Problems

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Standard Galerkin finite element discretizations applied to advection-dominated, elliptic PDEs can lead to highly oscillatory solutions, unless the grid is sufficiently fine. Over the years a number of stabilized methods, such as streamline upwind/Petrov Galerkin (SUPG) methods or Galerkin/Least-Squares (GALS) methods, were developed. These methods are frequently applied to advection-dominated elliptic PDEs. Local and global error estimates for these methods are well known.

In this talk we are interested in local and global error estimates of the SUPG stabilized numerical solution of optimal control problems. We show that the discretization error for this method in the optimal control context behaves differently as a function of the mesh size than it does for scalar advection-dominated elliptic problems. This is true even for local error estimates in the regions of smoothness, away from interior or boundary layers. We will provide error estimates for the computed solution of the optimal control problem and we will present numerical results to illustrate our findings.