ADAPTIVE CONTROL OF COUPLED CONTINUOUS DISCONTINUOUS GALERKIN METHODS APPLIED TO CONVECTION-DIFFUSION EQUATIONS

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Discontinuous Galerkin finite element methods have been under rapid development recently, as they have a number of important features rendering them useful for numerical computation. They allow for higher order approximations and adaptivity while satifying conservation statements element by element, though at a higher cost than standard continuous Galerkin methods. A multi-algorithmic domain decomposition approach that couples and exploits the best features of both conforming and discontinuous Galerkin methods is an appealing numerical technique [1].

Furthermore, a promising strategy to achieve a compromise between the accuracy of the numerical technique and the computational cost is to adaptively increase the complexity of the model where necessary [2]. We utilize an adaptive framework to apply the appropriate numerical method in particular regions of interest. The use of a computationally modified model can be balanced against mesh refinement techniques based on discontinuous Galerkin a posteriori error estimates for convection-diffusion equations. Derivation and implementation of a posteriori modelling error estimates are currently under development.

A strategy of this type which applies an appropriate model to a particular region of interest is particularly useful for resolving convection-diffusion problems with coefficients undergoing strong spatial heterogeneities. Numerical results for adaptive modeling of porous media in environmental flow problems are presented.

References

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[2] M. Braack and A. Ern, "A posteriori control of modeling errors and discretization errors", *SIAM J. Multiscale Modeling and Simulation*, v. 1(2), p. 221-238, 2003.