A Posteriori Error Estimate for Hp-version Discontinuous Galerkin Method for Convection-Diffusion-Reaction Equation on Polytopic Meshes

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Abstract

We derive a hp-version aposteriori error estimator for interior penalty discontinuous Galerkin discretizations of general convection diffusion reaction equations on polygonal/polyhedral meshes. The method employs polynomial approximation spaces on agglomerated meshes generated by a recently introduced R-tree based construction [1]. The proposed estimator provides a reliable global upper bound for the discretization error measured in a norm combining the standard energy norm and a seminorm associated with the convection term. In addition, the interpolation results of Karakashian and Pascal are extended to the present discontinuous Galerkin framework on general agglomerated meshes. Numerical experiments confirm the robustness and effectiveness of the proposed method with respect to both the mesh size and the degree of the polynomial.

References

[1] M. Feder, A. Cangiani, and L. Heltai, R3MG: R-tree based agglomeration of polytopal grids with applications to multilevel methods, *Journal of Computational Physics*, vol. 526, p. 113773, 2025.