Staggered Discontinuous Galerkin Methods on General Meshes

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Abstract

In this talk, we first present the staggered Discontinuous Galerkin method on general meshes for the Poisson equation. Adaptive mesh refinement is an attractive tool for general meshes due to their flexibility and simplicity in handling hanging nodes. We derive a simple residual-type error estimator. Numerical results indicate that optimal convergence can be achieved for both the potential and vector variables, and the singularity can be well-captured by the proposed error estimator. Then, an application to a single-phase flow in porous media with a fracture is considered. The bulk variables are solved using staggered DG method and an interface variable is solved using the continuous Galerkin method. We derive optimal convergence for both pressure and velocity fields. Numerical experiments suggest that our method is more accurate when polygonal meshes are used among various mesh configurations; moreover, our method is robust to mesh distortion. These observations allow us to consider unfitted methods without any special treatment. With background meshes generated independent of fracture, numerical solutions converge in optimal order. This is joint work with Eric Chung, Dohyun Kim, and Lina Zhao.

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