# A Priori and A Posteriori Error Estimation for an Expanded Staggered DG Method

Sanghee Lee [1] , Eun-Jae Park [1] , and Dohyun Kim [1]

1) *School of Mathematics and Computing (Computational Science and Engineering), Yonsei University, Seoul 03722, Korea*

Corresponding Author : Eun-Jae Park, ejpark@yonsei.ac.kr

## ABSTRACT

In this poster, we present an expanded staggered discontinuous Galerkin method for solving diffusion problems on general meshes. We introduce an auxiliary variable for the pressure gradient, which enables the tensor coefficient not to be inverted. It is desirable especially when a degenerating diffusion coefficient is considered. *A priori* and *A posteriori* error estimations are established. *A priori* error estimation gives the optimal convergence rates in $L^2$-norms for the pressure, flux, and the auxiliary variables. On the other hand, we construct a residual-based error estimator $\eta$ on the $L^2$-errors of the flux and the auxiliary variables. *A posteriori* error analysis shows that the estimator is reliable and efficient. Optimal convergence rates for all the variables are successfully achieved in the numerical experiments even for the distorted grids. In particular, a singularity is well-captured by the adaptive mesh refinement process with the error estimator $\eta$.

## REFERENCES

1. Kim, D. and Park, E.-J., “A Posteriori Error Estimator for Expanded Mixed Hybrid Methods”, *Numer. Methods Partial Differential Equations*, Vol. 23, 2006, pp. 330-349.
2. Zhao, L. and Park, E.-J., “A Staggered Discontinuous Galerkin Method of Minimal Dimension on Quadrilateral and Polygonal Meshes”, *SIAM J. Sci. Comput.*, Vol. 40, 2018, pp. 2543–2567.