A HYBRID DISCONTINUOUS GALERKIN METHOD FOR CONVECTION-DIFFUSION-REACTION PROBLEMS

YOUNGMOK JEON, EUN-JAE PARK, AND DONG-WOOK SHIN

ABSTRACT. A hybrid discontinuous Galerkin method introduced by Y. Jeon and E.-J. Park [Y. Jeon and E.-J. Park, SIAM J. Numer. Anal., 48 (2010), pp.1968-1983] is applied to approximate convection-diffusion-reaction problems. The hybrid discontinuous Galerkin method can be viewed a hybridizable discontinuous Galerkin method [B. Cockburn, J. Gopalakrishnan, and R. Lazarov, SIAM J. Numer. Anal., 47 (2009), pp.1319-1365] using a Bauman-Oden type local solver. The method conserves the mass in each element and the average flux is continuous across the interelement boundary for even degree polynomial approximations. In this work, we propose upwind version of hybrid discontinuous Galerkin method to resolve layers arising in convection dominated diffusion equations. The stability of the formulation is proved, as is order $k + 1/2$ convergence for the convection-dominated case and order $k + 1$ convergence for the diffusive limit in the $L^2$ norm. Several numerical examples are presented to show the performance of the method.

Keywords: hybridization, discontinuous Galerkin, convection-diffusion-reaction

Department of Mathematics, Ajou University, Suwon 443-749, KOREA
E-mail address: yjeon@ajou.ac.kr

Department of Computational Science and Engineering, Yonsei University, Seoul 120-749, KOREA.
E-mail address: ejpark@yonsei.ac.kr

Department of Computational Science and Engineering, Yonsei University, Seoul 120-749, KOREA
E-mail address: nada1533@yonsei.ac.kr