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STAGGERED DISCONTINUOUS GALERKIN METHOD AND FETI-DP PRECONDITIONERS FOR THE STOKES SYSTEM

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Discontinuous Galerkin (DG) methods are a class of efficient tools for solving fluid flow problems. There are in literature many DG methods with great success. In this paper, a new staggered discontinuous Galerkin method for the Stokes system is developed and analyzed. The key feature of our method is that the discrete system preserves the structures of the continuous problem, which results from the use of our new staggered DG spaces. This also provides local and global conservation properties, which are desirable for fluid flow applications. Stability and optimal convergence of the method are proved. Moreover, a superconvergence result with respect to a discrete H^1-norm for the velocity is proved. Furthermore, a local postprocessing technique is proposed to improve divergence free property of the velocity approximation and it is proved that the postprocessed velocity retains the original accuracy and is weakly divergence free with respect to pressure test functions. In addition, FETI-DP preconditioners are developed for the fast solutions of the resulting linear system. The research is supported by Hong Kong RGC General Research Fund (Project number: 401010).

REFERENCES

[1] H. Kim, E. Chung and C. Lee. A staggered discontinuous Galerkin method for the Stokes system. *SIAM J. Numer. Anal.*, To appear.

[2] H. Kim, E. Chung and C. Lee. FETI-DP preconditioners for a staggered discontinuous Galerkin formulation of the two-dimensional Stokes system. Submitted.