AN HDG METHOD FOR LINEAR ELASTICITY WITH STRONG SYMMETRIC STRESSES

WEIFENG QIU, JIGUANG SHEN, AND KE SHI

Abstract. In this talk we presents a new hybridizable discontinuous Galerkin (HDG) method for linear elasticity on general polyhedral meshes, based on a strong symmetric stress formulation, [1]. The key feature of this new HDG method is the use of a special form of the numerical trace of the stresses, which makes the error analysis different from the projection-based error analyzes used for most other HDG methods. For arbitrary polyhedral elements, we approximate the stress by using polynomials of degree $k \geq 1$ and the displacement by using polynomials of degree $k+1$. In contrast, to approximate the numerical trace of the displacement on the faces, we use polynomials of degree k only. This allows for a very efficient implementation of the method, since the numerical trace of the displacement is the only globally-coupled unknown, but does not degrade the convergence properties of the method. Indeed, we prove optimal orders of convergence for both the stresses and displacements on the elements. These optimal results are possible thanks to a special superconvergence property of the numerical traces of the displacement, and thanks to the use of a crucial elementwise Korn's inequality.

Keywords: hybridizable; discontinuous Galerkin; superconvergence; linear elasticity

Mathematics Subject Classifications (2010): 65N30, 65L12.

References

[1] W. Qiu, J. Shen and K. Shi, *An HDG method for linear elasticity with strong symmetric stresses*. Math. Comp. 87 (2018), pp: 69-93.

Department of Mathematics, City University of Hong Kong, 83 Tat Chee Avenue, Kowloon, Hong Kong, China
E-mail address: weifeqiu@cityu.edu.hk

Microsoft Corp. Redmond, WA.
E-mail address: shenx179@umn.edu

Department of Mathematics & Statistics, Old Dominion University, Norfolk, VA 23529, USA
E-mail address: kshi@odu.edu