

A LOCKING-FREE POLYGONAL STAGGERED DG METHOD FOR THE BIOT SYSTEM OF POROELASTICITY

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ABSTRACT. In this talk, we present a staggered discontinuous Galerkin method for a five-field formulation of the Biot system of poroelasticity on general polygonal meshes. Elasticity is equipped with stress-displacement-rotation formulation with weak stress symmetry for arbitrary polynomial orders, which extends the piecewise constant approximation developed in (L. Zhao and E.-J. Park, *SIAM J. Sci. Comput.* 42:A2158-A2181,2020). The proposed method is locking free and can handle highly distorted grids possibly including hanging nodes, which is desirable for practical applications. We prove the convergence estimates for the semi-discrete scheme and fully discrete scheme for all the variables in their natural norms. In particular, the stability and convergence analysis do not need a uniformly positive storativity coefficient. Moreover, to reduce the size of the global system, we propose a five-field formulation based fixed stress splitting scheme, where the linear convergence of the scheme is proved. Several numerical experiments are carried out to confirm the optimal convergence rates and the locking-free property of the proposed method.

Keywords: Staggered DG, General polygonal mesh, Locking-free, Fixed stress splitting, Weak symmetry, Biot system, Poroelasticity

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