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A compact-stencil scheme on polyhedral meshes for steady transport equations*

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Abstract

In this work [1], we present a new vertex-based scheme for the steady transport problem on polyhedral meshes. This scheme extends the stabilized Lagrange finite element on general meshes while containing the total number of degrees of freedom, *i.e.* considering only those attached to mesh vertices. The key idea is to consider scalar degrees of freedom attached to both mesh vertices and mesh cells (as for VAG schemes [2]). Taking inspiration from the recent analysis of composite finite element schemes in [3], the scheme is partially stabilized using the Continuous Interior Penalty approach (see [4]) so as to not hamper the possibility to eliminate locally cell-based unknowns. Well-posedness is obtained from an inf-sup condition and a priori error estimates are inferred for smooth and rough solutions. Numerical results are finally presented on three-dimensional polyhedral meshes, and the benefit of our approach is illustrated in terms of computational cost.

Key words: polyhedral meshes, transport equations, a priori error analysis

Mathematics subject classifications (1991): 65N12, 65N30, 65N08

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