

PARALLEL MULTILEVEL PRECONDITIONERS FOR VIRTUAL ELEMENT DISCRETIZATIONS OF SADDLE POINT PROBLEMS

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ABSTRACT. The Virtual Element Method (VEM) is a recent technology for the numerical approximation of partial differential equations on computational grids constituted by polygonal or polyhedral elements of very general shape. The aim of this work is to develop effective linear solvers for general order VEM approximations of three-dimensional scalar elliptic equations in mixed form and Stokes equations. To this end, we consider block algebraic multigrid preconditioners and balancing domain decomposition by constraints (BDDC) preconditioners. The latter allow us to use conjugate gradient iterations, although the algebraic linear systems resulting from the discretization of the differential problems are indefinite.

Keywords: Virtual Element Method; Saddle-point linear systems; Parallel computing; Domain Decomposition; BDDC method.

Mathematics Subject Classifications (2010): 65F08; 65N30; 65N35; 65N55

REFERENCES

- [1] F. Dassi and S. Scacchi. Parallel solvers for virtual element discretizations of elliptic equations in mixed form. *Computers & Mathematics with Applications*, 79 (7): 1972–1989, 2020.
- [2] F. Dassi, S. Zampini and S. Scacchi. Robust and scalable adaptive BDDC preconditioners for virtual element discretizations of elliptic partial differential equations in mixed form. *Computer Methods in Applied Mechanics and Engineering*, 391: 114620, 2022.
- [3] T. Bevilacqua and S. Scacchi. BDDC Preconditioners for Divergence Free Virtual Element Discretizations of the Stokes Equations. *Journal of Scientific Computing*, 92 (2): 63, 2022.

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