FETI-DP and BDDC Preconditioners for the Virtual Element Method in two and three dimension

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ABSTRACT

In order for the Virtual Element Method ([1]) to reach its full potential it is also necessary to deal with the efficient solution of the resulting linear system, and, in particular, to provide good preconditioners. In view of a possible parallel implementation of the method we choose here to consider a Domain Decomposition approach [2]. In particular, we focus on the two preconditioning techniques which are, nowadays, considered as the most efficient: FETI-DP and BDDC. Letting S_{VEM} denote the stiffness matrix arising for the VEM discretization of order k and mesh size h of the two dimensional Poisson problem, and letting P_{FETI} and P_{BDDC} denote the two preconditioner obtained by, respectively, the FETI and the BDDC approach, with subdomain diameter H, we prove that, under suitable "shape regularity" assumptions on the polygonal tessellation, we have the following bounds (which we support by numerical tests):

$$\kappa(P_{FETI}^{-1}S_{VEM}) \lesssim (1+\log(H/h))^2 \qquad \kappa(P_{BDDC}^{-1}S_{VEM}) \lesssim (1+\log(H/h))^2,$$

where κ denote the condition number. The extension of this result to the three dimensional case (at least for the lowest order discretization) and the influence of the geometry of the elements on the above estimates will also be discussed.

REFERENCES

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