VEM approximation for the Stokes eigenvalue problem: a priori and a posteriori error analysis

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Abstract

We present an *inf-sup* stable *divergence free* virtual element method and associated *a priori*, and *a posteriori* error analysis to approximate the eigenvalues and eigenfunctions of the Stokes spectral problem in one shot. For the a priori analysis, we take advantage of the compactness of the solution operator to prove convergence of the eigenfunctions and double order convergence of eigenvalues. Additionally we also propose an a posteriori estimator of residual type, which we prove is reliable and efficient, in order to perform adaptive refinements that allow to recover the optimal order of convergence for non smooth eigenfunctions. We report some numerical tests

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References

[1] P. F. Antonietti, L. Beirão da Veiga, D. Mora, and M. Verani, *A stream virtual element formulation of the Stokes problem on polygonal meshes*, SIAM J. Numer. Anal., 52 (2014), pp. 386–404.

[2] I. Babuska and J. Osborn, *Eigenvalue problems*, in Handbook of numerical analysis, Vol. II, Handb. Numer. Anal., II, North-Holland, Amsterdam, 1991, pp. 641–787.

[3] R. Verfürth, *A posteriori error estimation techniques for finite element methods*, Numerical Mathematics and Scientific Computation, Oxford University Press, Oxford, 2013.

[4]   N. Verma and S. Kumar, *Lowest order virtual element approximations for transient Stokes problem on polygonal meshes*, Calcolo, 58 (2021), pp. Paper No. 48, 35.