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A finite element analysis of a pseudostress formulation for the Stokes eigenvalue problem*

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Abstract

In this work we analyze a finite element approximation of the Stokes eigenvalue problem. We present a variational formulation of the problem relying only on the pseudostress tensor. We present an $H(div)$-conforming discretization of the problem by means of the lowest order Brezzi-Douglas-Marini mixed finite element. We show that the resulting scheme provides a correct approximation of the spectrum and prove optimal error estimates. Finally, we present some numerical experiments supporting our theoretical results.

Key words: Stokes equations; eigenvalue problem, finite elements, error estimates.

Mathematics subject classifications (1991): 65N25, 76D07, 65N30.

References

[1] I. Babuška and J. Osborn, *Eigenvalue Problems*, in Handbook of Numerical Analysis, Vol. II, P. G. Ciarlet and J. L. Lions, eds., North-Holland, Amsterdam, 1991, pp. 641–787.

[2] J. Descloux, N. Nassif, and J. Rappaz, *On spectral approximation. Part 1: The problem of convergence*, RAIRO Anal. Numér., vol. 12, 2, pp. 97-112, (1978).

[3] J. Descloux, N. Nassif, and J. Rappaz, *On spectral approximation. Part 2: Error estimates for the Galerkin method*, RAIRO Anal. Numér., vol. 12, 2, pp. 113-119, (1978).

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[4] C. Lovadina, M. Lyly and R. Stenberg, *A posteriori estimates for the Stokes eigenvalue problem*. Numer. Methods Partial Differential Equations, vol. 25, pp. 244-257 (2009).