Rayleigh–Ritz approximation of the inf-sup constant for the divergence

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This contribution proposes a compatible finite element discretization for the approximation of the inf-sup constant for the divergence. The new approximation replaces the H^{-1} norm of a gradient by a discrete H^{-1} norm which behaves monotonically under mesh-refinement. By discretizing the pressure space with piecewise polynomials, upper bounds to the inf-sup constant are obtain ed. The scheme enables an approximation with arbitrary polynomial degrees. It can be viewed as a Rayleigh–Ritz method and it gives monotonically decreasing approximations of the inf-sup constant under mesh refinement. In particular, the computed approximations are guaranteed upper bounds for the inf-sup constant. The novel error estimates prove convergence rates for the approximation of the inf-sup constant provided it is an isolated eigenvalue of the corresponding non-compact eigenvalue problem; otherwise, plain convergence is achieved. Numerical computations on uniform and adaptive meshes are presented.

References

[1] D. Gallistl, Rayleigh-Ritz approximation of the inf-sup constant for the divergence, *Math. Comp.*, **88** (2019), pp. 73–89.