APPROXIMATION OF THE MAXWELL EIGENVALUE PROBLEM BY A RESIDUAL BASED STABILIZED FINITE ELEMENT METHOD

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ABSTRACT

We consider a stabilized finite element formulation motivated by a variational multiscale approach for approximating the Maxwell eigenvalue problem. The eigenproblem is reformulated as a saddle point problem by enforcing the divergence constraint with a Lagrange multiplier that vanishes in an appropriate setting. The stabilization technique consists in division of the unknowns into a finite element component and a subgrid scale that needs to be modeled feasibly. The essential conception is to regard the latter as orthogonal to the former which redistributes the stabilization terms in the residual. This results in an approximate eigenvalue problem that inherits the linearity of the original one, and allows the use of arbitrary interpolations for all the unknowns. Consequently, the approach paves the way to attain a scheme implemented with the (computationally) efficient continuous Lagrangian interpolations. The stability and convergence aspects are inherited from [1, 2] where the method has been proposed for the corresponding source problem. The analysis of the eigenvalue problem accounts for the classical spectral theory applied to the associated source problem in the framework developed in [3]. We investigate the numerical performance of the formulation and provide some convergence results for several tests with reference solutions.

References

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