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Fortin operator and discrete compactness for edge elements. (English) Zbl 0967.65106
Numer. Math. 87, No. 2, 229-246 (2000).

A Fortin operator is constructed for tetrahedral edge elements of any order in the case of polyhedral domains. The construction is also valid for more general domains with convenient regularity hypotheses, which are satisfied by polyhedral domains. Although Fortin operators for edge elements have been introduced by other authors, they usually place restrictions such as quasiuniformity of the mesh or stronger regularity hypotheses, in order to be able to prove convergence of the operator to the identity.

As a matter of fact, the main result in the paper gives a uniform estimate in the approximation of the identity in the L^2 norm that depends only on the size of the mesh. This is proved after thoroughly discussing the main differences and similarities of edge and face elements in three dimensions, taking into account that edge elements are suitable for problems involving the curl operator.

A final section deals with the application of the Fortin operator presented in the paper to numerically solve general Maxwell eigenvalue problems. For them it is proved by applying the main result, that the Fortin operator in this paper cannot produce spurious solutions.

Reviewer: [Juan Pedro Milaszewicz \(Buenos Aires\)](#)

MSC:

- [65N30](#) Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs
- [65N25](#) Numerical methods for eigenvalue problems for boundary value problems involving PDEs
- [78A25](#) Electromagnetic theory, general
- [35J25](#) Boundary value problems for second-order elliptic equations
- [78M10](#) Finite element, Galerkin and related methods applied to problems in optics and electromagnetic theory
- [65N12](#) Stability and convergence of numerical methods for boundary value problems involving PDEs

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Keywords:

[edge elements](#); [Fortin operator](#); [uniform estimates](#); [polyhedral domains](#); [curl operator](#); [finite element method](#); [convergence](#); [Maxwell eigenvalue problems](#); [spurious solutions](#)

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