ADAPTIVE FINITE ELEMENT METHODS FOR EIGENVALUE PROBLEMS

DANIELE BOFFI

Abstract. The adaptive finite element method (AFEM) is a mature technique for the computation of approximate solutions of partial differential equations.

AFEM's for eigenvalues problems have been successfully implemented and analyzed in the case of various applications; as usually when dealing with eigenvalue problems, most available results deal with eigenmodes of multiplicity one.

Only recently an active research field was focused on the approximation of multiple eigenvalues and, more generally, of cluster of eigenvalues. This new viewpoint opens new scenarios and raises several questions, some of which will be discussed during this talk.

Another critical aspect about the theoretical analysis of AFEM's for eigenvalue problems concerns the approximation of eigenpblems in mixed form. We will discuss the optimal convergence of the AFEM applied to the Laplace eigenvalue problem in mixed form; our analysis applies to standard simplicial mixed schemes, in two and three dimensions and is cluster-robust. The quasi-orthogonality property has been proved by using a suitable superconvergence.

Some of the results presented in this talk are based on references [1,2].

Keywords: Adaptive finite element, mixed finite elements, cluster of eigenvalues, optimal rate of convergence

Mathematics Subject Classifications (2010): 65N30, 65N25, 65N50

References

[1] D. Boffi, R.G. Durán, F. Gardini, and L. Gastaldi. A posteriori error analysis for nonconforming approximation of multiple eigenvalues. To appear in Mathematical Methods in the Applied Sciences. arXiv:1404.5560 [math.NA]

[2] D. Boffi, D. Gallistl, F. Gardini, and L. Gastaldi. Optimal convergence of adaptive FEM for eigenvalue clusters in mixed form. Submitted. arXiv:1504.06418 [math.NA]

Dipartimento di Matematica "F. Casorati", University of Pavia, Italy
E-mail address: daniele.boffi@unipv.it