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Non-conforming finite element methods for transmission eigenvalue problem ⋆

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Abstract

The transmission eigenvalue problem is an important and challenging topic arising in the inverse scattering theory. In this paper, for the Helmholtz transmission eigenvalue problem, we give a weak formulation which is a nonselfadjoint linear eigenvalue problem. Based on the weak formulation, we first discuss the non-conforming finite element approximation, and prove the error estimates of the discrete eigenvalues obtained by the Adini element, the Morley-Zienkiewicz element, the modified-Zienkiewicz element et. al. And we report some numerical examples to validate the efficiency of our approach for solving transmission eigenvalue problem.

Key words: transmission eigenvalue, the weak formulation, non-conforming finite elements, error estimates.

1 Introduction

The transmission eigenvalue problems have important physical background, for example, they can be used to obtain estimates for the material properties of the scattering object [7,8,26]. In addition, transmission eigenvalues have theoretical importance in the uniqueness and reconstruction in inverse scattering theory [14]. Recently significant progresses of the existence of transmission eigenvalues and applications have been made (see [8] and the survey paper [9]).

In recent years, the computation of transmission eigenvalues has attracted the

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