

# A VIRTUAL ELEMENT METHOD FOR THE TRANSMISSION EIGENVALUE PROBLEM

DAVID MORA AND IVÁN VELÁSQUEZ

**ABSTRACT.** In this talk, we develop a Virtual Element Method (VEM) for solving a non-self-adjoint fourth-order eigenvalue problem derived from the transmission eigenvalue problem. We write a variational formulation and propose a  $C^1$ -conforming discretization by means of the VEM. We use the classical approximation theory for compact non-self-adjoint operators to obtain optimal order error estimates for the eigenfunctions and a double order for the eigenvalues. Finally, we present some numerical experiments illustrating the behavior of the virtual scheme on different families of meshes.

**Keywords:** Virtual element method, transmission eigenvalue, spectral problem, error estimates.

**Mathematics Subject Classifications (2010):** 65N25, 65N30, 65N21, 78A46.

## REFERENCES

- [1] P.F. Antonietti, L. Beirão da Veiga, S. Scacchi and M. Verani. A  $C^1$  virtual element method for the Cahn–Hilliard equation with polygonal meshes. *SIAM Journal on Numerical Analysis*, 54(1):36-56, 2016.
- [2] L. Beirão da Veiga, F. Brezzi, L.D. Marini and A. Russo. The hitchhiker’s guide to the virtual element method. *Math. Models Methods Appl. Sci.*, 24:1541-1573, 2014.
- [3] F. Brezzi and L.D. Marini. Virtual elements for plate bending problems. *Computer Methods in Applied Mechanics and Engineering*, 253:455-462, 2012.
- [4] F. Cakoni, P. Monk and J. Sun. Error analysis for the finite element approximation of transmission eigenvalues. *Computational Methods in Applied Mathematics*, 14(4):419-427, 2014.
- [5] F. Gardini and G. Vacca. Virtual element method for second-order elliptic eigenvalue problems. *IMA J. Numer. Anal.*, 38(4):2026-2054, 2018.
- [6] D. Mora, G. Rivera and I. Velásquez. A virtual element method for the vibration problem of Kirchhoff plates. *ESAIM Mathematical Modelling and Numerical Analysis*, 52(4):1437-1456, 2018.

GIMNAP, DEPARTAMENTO DE MATEMÁTICA, UNIVERSIDAD DEL BÍO-BÍO, CASILLA 5-C, CONCEPCIÓN, CHILE, AND CI<sup>2</sup>MA, UNIVERSIDAD DE CONCEPCIÓN, CONCEPCIÓN, CHILE  
*E-mail address:* dmora@ubiobio.cl

CI<sup>2</sup>MA, DEPARTAMENTO DE INGENIERÍA MATEMÁTICA, UNIVERSIDAD DE CONCEPCIÓN, CONCEPCIÓN, CHILE.  
*E-mail address:* ivelasquez@ing-mat.udec.cl