

# MINIMUM-RESIDUAL A POSTERIORI ERROR ESTIMATES FOR A HYBRIDIZABLE DISCONTINUOUS GALERKIN DISCRETIZATION OF THE HELMHOLTZ EQUATION

LILIANA CAMARGO, SERGIO ROJAS, AND PATRICK VEGA

**ABSTRACT.** We propose reliable and efficient a posteriori error estimators for a hybridizable discontinuous Galerkin (HDG) discretization of the Helmholtz equation with mixed boundary conditions based on residual minimization. Such residual minimizations are performed on local postprocessing schemes of the approximation of the scalar solution provided by the HDG scheme. As a result, we obtain new postprocessed approximations for the scalar solution and residual representatives in the Riesz sense, which are further employed to derive a posteriori estimators. We illustrate our theoretical findings and the behavior of the a posteriori error estimators through two ad-hoc numerical experiments.

**Keywords:** residual minimization, postprocessing, a posteriori error analysis, adaptive mesh refinement.

**Mathematics Subject Classifications (2010):** 65N12, 65N15, 65N22, 65N30, 65N50.

**Funding:** LC was supported by the Chilean grant DI Postdoctorado 2022 (PUCV). SR was supported by the Chilean National Agency for Research and Development (ANID) through FONDECYT project 3210009. PV was funded by the Chilean grant ANID FONDECYT 3220858.

## REFERENCES

- [1] L. Camargo, S. Rojas, and P. Vega. Minimum-residual a posteriori error estimates for a hybridizable discontinuous Galerkin discretization of the Helmholtz equation *arXiv preprint*, arXiv:2304.00418, 2023.
- [2] I. Muga, S. Rojas, and P. Vega. An adaptive superconvergent mixed finite element method based on local residual minimization *SIAM Journal on Numerical Analysis*, 61(5):2084-2105, 2023.

INSTITUTO DE MATEMÁTICAS, PONTIFICIA UNIVERSIDAD CATÓLICA DE VALPARAÍSO, CHILE.  
*Email address:* `liliana.camargo@pucv.cl`

INSTITUTO DE MATEMÁTICAS, PONTIFICIA UNIVERSIDAD CATÓLICA DE VALPARAÍSO, CHILE.  
*Email address:* `sergio.rojas.h@pucv.cl`

DEPARTAMENTO DE MATEMÁTICA Y CIENCIA DE LA COMPUTACIÓN, UNIVERSIDAD DE SANTIAGO DE CHILE, CHILE.  
*Email address:* `patrick.vega@usach.cl`