

# A NON-CONFORMING DOMAIN DECOMPOSITION APPROXIMATION FOR THE HELMHOLTZ SCREEN PROBLEM WITH HYPERSINGULAR OPERATOR

NORBERT HEUER AND GREDY SALMERÓN

ABSTRACT. We present and analyze a non-conforming domain decomposition approximation for a hypersingular operator governed by the Helmholtz equation in three dimensions. This operator appears when considering the corresponding Neumann problem in unbounded domains exterior to open surfaces. We consider small wave numbers and low-order approximations with Nitsche coupling across interfaces. Our results are based on [1, 2] which analyze the case of the Laplacian, with Nitsche and mortar couplings, respectively.

Under appropriate assumptions on mapping properties of the weakly singular and hypersingular operators with Helmholtz kernel, we prove that our method converges almost quasi-optimally. Numerical experiments confirm our error estimate.

**Keywords:** Helmholtz problem, hypersingular operator, boundary element method, domain decomposition, Nitsche method

**Mathematics Subject Classifications (2010):** 65N38, 65N55

## REFERENCES

- [1] F. CHOULY AND N. HEUER, *A Nitsche-based domain decomposition method for hypersingular integral equations*, Numer. Math., 121 (2012), pp. 705–729.
- [2] M. HEALEY AND N. HEUER, *Mortar boundary elements*, SIAM J. Numer. Anal., 48 (2010), pp. 1395–1418.
- [3] N. HEUER AND G. SALMERÓN, *A non-conforming domain decomposition approximation for the Helmholtz screen problem with hypersingular operator*, arXiv 1506.00688, 2015.

FACULTAD DE MATEMÁTICAS, PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE, AVENIDA VICUÑA MACKENNA 4860, SANTIAGO, CHILE

*E-mail address:* {nheuer,gjsalmeron}@mat.puc.cl