SANTIAGO NUMÉRICO II
Quinto Encuentro de Análisis Numérico de Ecuaciones Diferenciales Parciales
Facultad de Matemáticas, Pontificia Universidad Católica de Chile, Diciembre 9–11, 2010

A Nitsche-based domain decomposition for hypersingular integral equations *

Franz Chouly † Norbert Heuer ‡

Abstract

We have recently analyzed several non-conforming boundary element discretizations of hypersingular boundary integral equations, namely Lagrangian multipliers for essential conditions on the boundary of open surfaces [1], Crouzeix–Raviart elements [3], and domain decomposition with so-called mortar coupling [2]. Even though none of the discrete formulations has a continuous setting (due to a missing well-posed trace operator in the corresponding energy space) they all converge quasi-optimally or almost quasi-optimally.

In this talk we present a domain decomposition method with Nitsche coupling. The principal advantage of the Nitsche coupling is that it allows for symmetric linear systems.

We prove almost quasi-optimal convergence of this method for hypersingular integral equations in broken Sobolev norms of order 1/2. Sub-domain decompositions can be geometrically non-conforming and meshes must be quasi-uniform only on sub-domains. Numerical results confirm the theory.

References

[1] G. N. Gatica, M. Healey, and N. Heuer, *The boundary element method with Lagrangian multipliers*, Numerical Methods for Partial Differential Equations, vol. 25, pp. 1303–1319, (2009).

[2] M. Healey and N. Heuer, *Mortar Boundary Elements*, SIAM Journal on Numerical Analysis, vol. 48, pp. 1395–1418, (2010).

[3] N. Heuer and F.-J. Sayas, *Crouzeix–Raviart boundary elements*, Numerische Mathematik, vol. 112, pp. 381–401, (2009).

*This research was partially supported by FONDECYT-Chile under grant number 1080044.

†Laboratoire de Mathématiques - UMR CNRS 6623, Université de Franche Comté, 16 route de Gray, 25030 Besançon Cedex, France, e-mail: franz.chouly@univ-fcomte.fr

‡Facultad de Matemáticas, Pontificia Universidad Católica de Chile, Avenida Vicuña Mackenna 4860, Santiago, Chile, e-mail: nheuer@mat.puc.cl