

# Stable FEM-BEM coupling for Helmholtz Transmission Problems

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## 1 Abstract

Most boundary integral equations for exterior scattering problems suffer from instabilities arising from interior resonances. These instabilities will carry over to standard symmetric coupled finite element and boundary element methods for Helmholtz transmission problems although the underlying transmission problem is well-posed.

In the case of exterior scattering problems combined field integral equations are often used to obtain well-posed variational formulations. However, in the sound-soft case these formulations still need to be regularized further in order to arrive at coercive variational formulations amenable to standard Galerkin error estimates.

We will rely on the idea of regularization to obtain a well-posed variational problem for the Helmholtz transmission problem. The main tool is the Calderon projector which can be used to obtain a symmetric regularized DtN-map. This DtN-map can then be used to derive resonance free variational problems which are suitable for Galerkin discretizations. Furthermore this new formulations will make it possible to apply classical convergence results for conforming Galerkin schemes.

### References:

- A. Buffa, R. Hiptmair, *Regularized combined field integral equations*, submitted to Numer. Math. Sep 2003.
- R. Hiptmair, P. Meury, *Stable FEM-BEM coupling for Helmholtz transmission problems*, SAM Report, in preparation.