Halfspace Matching for Junctions of 2D Open Waveguides

Julian Ott

julian.ott@kit.edu
Karlsruhe Institute for Technology

Joint work with A.S. Bonnet-BenDhia, S. Fliss, C. Hazard, A. Tonnoir

March 30, 2016

We study a scattering problem at a junction of open waveguides in 2D, modeled by the Helmholtz equation

$$\Delta u(x) + (k^2(x) + i\epsilon)u(x) = 0, \quad x \in \mathbb{R}^2 \setminus (-a, a) \times (-a, a),$$

with some limiting absorption $\epsilon > 0$ and space–dependend wavenumber k, where possible configuration is sketched below. More specifically, we will consider a reformulation using halfspace representations, which yields a system of integral equations. This technique of separation into halfpaces has been studied in [1] for the free space without waveguides, and we present some extensions: For problem on the exterior to a square with halfspaces containing waveguides, the integral formulation can be shown to be of Fredholm type and well posed. We will conclude by showing numerical examples (for the non-absorptive case), where the method has been employed for optimization of open waveguide-junctions.

References

[1] A. Tonnoir. *Conditions transparentes pour la diffraction d'ondes en milieu élastique anisotrope.* PhD Thesis, ENSTA ParisTech, 2015.

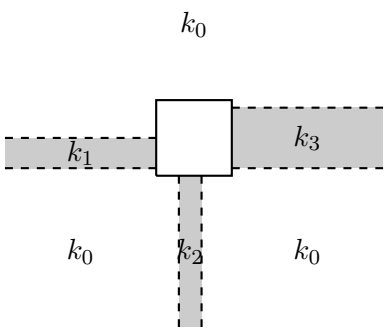

Figure 1: Example material coefficient k, to which our method is applicable: $k(x) = k_i$, $i \in \{1, 2, 3\}$ in the grey areas, and $k(x) = k_0$ outside.