

THE CLOAKING EFFECT IN METAMATERIALS: BEYOND ELLIPTICITY

D. KREJČIŘÍK

In mathematical models of metamaterials characterized by negative electric permittivity and/or negative magnetic permeability, there appear operators of the type

$$\operatorname{div} \operatorname{sgn} \operatorname{grad},$$

where $\operatorname{sgn}(x) = \pm 1$ for $x \in \Omega_{\pm}$, two disjoint subsets of \mathbb{R}^d divided by a smooth hypersurface.

Open problem: How to define such an operator as a self-adjoint operator in an L^2 setting?

There exist numerous works on a changed problem in which there is a small complex constant added to the minus one in the sign function (making the problem non-self-adjoint, but sectorial). The only exception (apart from the one-dimensional situation, which is elementary) seems to be my recent joint paper with Behrndt [BK]. Here we solve the original problem for a particular geometry (rectangle) with help of a refined extension theory. It turns out that the domain of the self-adjoint operator is not a subset of the Sobolev space H^1 and there is an essential spectrum (although the geometry is bounded).

REFERENCES

- [BK] J. Behrndt and D. Krejčířík. An indefinite Laplacian on a rectangle. *J. Anal. Math.* (to appear). arXiv: 1407.7802, <http://arxiv.org/abs/1407.7802>.