Solving Electromagnetic Eigenvalue Problems via an Isogeometric Boundary Element Method and Contour Integration

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ABSTRACT

One can solve electromagnetic scattering problems of perfect conductors governed by the electric wave equation via an isogeometric discretisation of the electric field integral equation [1]. While this approach comes with a high accuracy per degree of freedom and yields high orders of convergence w.r.t. the pointwise error of the electric field, one must assume non-resonant wave number. Otherwise, the problem is rendered ill-posed.

Because of this and the fact that the electric field integral equation depends on the wave number in a non-polynomial fashion, this approach seems unsuitable to solve the corresponding eigenvalue problem.

However, through a class of methods called *contour integral methods*, see e.g. [2], non-linear eigenvalue problems of the form

$$A(\kappa)v = 0, \qquad v \neq 0,$$

can be solved for the eigenpair (κ, v) with high accuracy, low computational effort, and without having to evaluate A, in our case given by the electric single layer operator, at the resonant frequency.

In this talk, we will review both the isogeometric boundary element method and the contour integral method. We will pinpoint the most interesting theoretical assertions, discuss implementation, and present numerical results. Doing so, we will show that isogeometric boundary element methods paired with contour integration techniques offer a competitive approach to the solution of interior eigenvalue problems with high demands on accuracy.

Acknowledgement: The work of Felix Wolf is supported by the 'Excellence Initiative' of the German Federal and State Governments and the Graduate School of Computational Engineering at Technische Universität Darmstadt. Moreover, the work of Felix Wolf is also supported by DFG-grants SCHO1562/3-1 and KU1553/4-1.

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