IGA BEM for Maxwell eigenvalue problems
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Abstract  Joint work with coauthors Felix Wolf and Sebastian Schöps.
Superconducting cavities are standard components of particle accelerators. Their design is typically described by parametrized ellipses and determined by mathematical optimization. The simulation model is subject to demanding requirements, such as a relative accuracy of $10^{-9}$ for the resonance frequency of the accelerating mode. Since the geometry and the electromagnetic fields are smooth, an approach in the gist of isogeometric analysis (IGA) suggests itself. The geometry is modeled by a NURBS mapping, while the electromagnetic fields are discretized by the B-spline de Rahm complex [?]. An IGA finite element method (FEM) for the Maxwell eigenvalue problem was investigated and showed promising results [?]. For the same accuracy, the number of required degrees of freedom was reduced by a factor $3\ldots9$ compared to classical FEM. However, CAD systems feature surface descriptions only, so the volumetric spline model had to be created manually.

To live up to the promises of IGA, namely closing the gap between design and analysis, we suggest an IGA boundary element method (BEM). We will review the state-of-the-art of all relevant building blocks. We will address the B-spline de Rham complex on a boundary manifold, the Galerkin discretization of the electric field integral equation, and present a convergence result. We will discuss a recent contour integral method [?] to solve the resulting non-linear eigenvalue problem. Aspects of integrating so-called ”fast methods” will also be presented, in particular Adaptive Cross Approximation [?] and Calderón preconditioning [?].