Surface Impedance Boundary Conditions for a Scattered Field Formulation

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Master thesis or HiWi job
Study field: Computational Engineering | Electrical Engineering
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Description

To improve the simulation of particle dynamics, we couple two types of solvers using a scattered field formulation to solve Maxwell's wave equations in the time domain. Herein, the total electric field E is decomposed into a prescribed incident field E_i and a scattered field E_s. The two are coupled by the PEC-boundary condition which the sum of the two fields (but not each individually) have to fulfill.

The aim of this thesis is to generalize the concept of a scattered field approach to non-perfectly conducting materials at the boundary. When using a single field formulation, one can use surface impedance boundary conditions (SIBC). We want to apply this concept also to the scattered field formulation and implement it into our current simulation code.

The student will gain a broad background in the modeling workflow: How to start from physical equations, how to transfer them to a discrete representation and how to finally implement an effective realization in an existing code framework.

Anticipated milestones:

- Gaining knowledge about wakefields, finite integration technique (FIT), SIBC (literature provided).
- Deriving a discrete SIBC formulation for the scattered field formulation.
- Implementing the derived formulation using the highly specialized C++ code PBCI

Prerequisites

Strong interest in numerical methods for electromagnetic field computations (PDEs, FIT) and their application. Interest in working with C++. Feel free to pass by Jonas Christ for more details.

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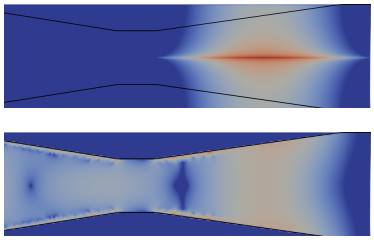

Figure 1: Incident (top) and scattered field (bottom) for a particle bunch traveling through a PEC chamber (black line).