LABORATOIRE D'ELECTROTECHNIQUE ET D'ELECTRONIQUE DE PUISSANCE DE LILLE

Master project, 2018-2019

— Development of the method to model the far field —
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Context:
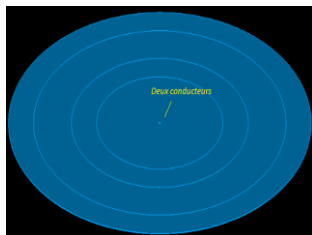
Since more 15 years, the OMN research group (Numerical Tools and Modelling, L2EP and EDF R&D) develops a software called Code_Carmel (**http://code-carmel.univ-lille1.fr**) to solve the Maxwell equations in 3D and in low frequency. This collaboration leads to the creation of a joint laboratory in 2006: the LAMEL (**http://lamel.univ-lille.fr**).

Code_Carmel can compute very precisely the behaviors of the electrical machines such that transformers, synchronous machines or induction machines. And the source code is constantly upgraded to improve its quality (accuracy, robustness and speed) and its accessibility (usability, maintainability and also easy access to new programmers).
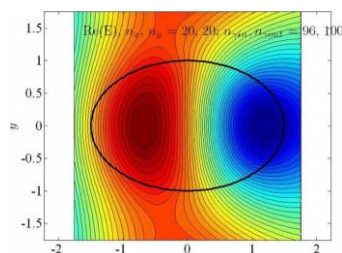
Currently, to compute fields outside of the machine (the leakage flux), we consider a large "air box". This dramatically increases the size of our model because this region must be meshed also. And thus, it increases the computation time for solving the problem.

Objective

The objective of the project is to implement inside Code_Carmel a method to take into account the boundary condition at the "infinity". The methods are well known [Tsukerman2006-2011, Tsynkov2003, Ryaben'kii2002] but still need to be implemented in our code.

Very large air box to model a cable

Plane wave scattering on a dielectric 2D cylinder [Tsukerman2011] "

Work steps

Bibliographic study about boundary conditions at the infinity
Follow and reproduce a 1D tutorial (analytical + provided program)
Choose an algorithm and program it inside a 2D finite element prototype with validation
Program the algorithm inside the 3D finite element Code_Carmel, with validation
Compare both approaches in 2D and 3D (with air box *vs.* boundary condition at the infinity)

Key word

Modelling and computing
Leakage flux

References

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Master "Electrical Energy for Sustainable Development"