Complementary eddy-current geometric formulations coupled with electric circuits

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1 Abstract

It is well known that when the efficient eddy-current formulations based on a magnetic scalar potential are employed in problems which involve conductive regions with holes, the so-called *thick cuts* are needed to render the boundary value problem well defined. Is has been already demonstrated, for example in [1-3], that thick cuts are representatives of the first cohomology group generators of the insulating region.

As pointed out in [1], thick cuts in the insulating region may be used to easily couple the T-Ω geometric eddy-current formulation with electric circuits. On the contrary, when considering the complementary A-χ geometric eddy-current formulation, thick cuts inside the conducting region have to be considered for this purpose, see [4].

New efficient algorithms to compute cohomology group generators have been developed in the last years. In this contribution, the results obtained by means of various reduction techniques [5-7] are investigated on real-sized meshes up to millions of tetrahedra.

Moreover, in most cases when there is the need to couple the A-χ formulation with circuits, a "torus-like" conductor is considered. In these cases, instead of using a costly cohomology computation, a linear complexity algorithm based on skeletonization plus Generalized Spanning Tree Technique (GSTT) [2-3] is introduced in [4]. Both skeletonization and GSTT may theoretically fail in some exceptional cases, which are extremely rare in practice in this application. Anyway, if the algorithm fails, pure cohomology computations are employed.

References

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