Alejandro Álvarez Menchón:

Title: Intensively Computational Electromagnetic Tecniques for the Analysis of Complex Communication Devices

Abstract:
Two types of intensive computational Electromagnetic techniques are being developed at the Electromagnetics and Telecommunications Group of the Technical University of Cartagena. They are computationally very intensive, although the nature and the philosophy behind the two techniques is very different. They are both based on the so-called Integral Equation technique, being the difference, the way the kernel of the integral equation is formulated. In the first technique, a very simple and analytic kernel is used. This approach puts the heavy computational requirements in the structure itself. Since little information of the structure is in the kernel, the whole geometry needs to be solved numerically. A dense discretization mesh is used to represent the fine geometrical details of the structure. When the geometry is complex, this approach ends up with the formulation of huge systems of linear equations. Using this approach, the bottleneck is to efficiently invert large systems of linear equations, which in addition are dense.

The second approach consists of using the symmetries of the problem and to apply inventiveness, to include in the kernel parts of the geometry under study. In this case the final numerical loading is considerably reduced, since some of the geometrical details are already included in the kernel. Consequently, they do not need to be treated or discretized during the numerical solution of the integral equations. With this approach, smaller systems of linear equations are formulated. However, the bottleneck is now moved to the calculation of the kernel. In fact, the formulation of the systems requires the calculation of the kernel values millions of times. For this approach, the inversion of large systems of linear equations is not important. Rather, the emphasis must now be put in the fast calculation of millions of small systems.

The talk will introduced these two different approaches, in order to search for the most efficient numerical techniques applied to the resolution of complex problems, using the two different formulations.

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