Hybrid Methods for Computational Electromagnetics in Frequency Domain

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Abstract

In this thesis we study hybrid numerical methods to be used in computational electromagnetics. The purpose is to address a wide frequency range relative to a given geometry. We also focus on efficient and robust numerical algorithms for computing the so-called Smooth Surface Diffraction predicted by Geometrical Theory of Diffraction (GTD). We restrict the presentation to frequency domain scattering problems.

The hybrid methods consist in combinations of Boundary Element Methods and asymptotic methods. Three hybrids will be presented. One of them has been developed from a theoretical idea to an industrial code. The two other hybrids will be presented mainly from a theoretical perspective.

To be able to compute the Smooth Surface Diffraction field we introduce a numerical method that is to be used with surface curvature sensitive meshing, complemented with auxiliary data taken from a geometry database. By using two geometry representations we can show first order convergence and we then achieve an efficient and robust numerical algorithm. This numerical algorithm may be an essential part of a GTD implementation which in its turn is a component in the hybrid methods.

As a background to our new techniques we will also give short introductions to the Boundary Element Method and the Geometrical Theory of Diffraction from a theoretical and implementational point of view.

**Keywords** Maxwell's equations, Geometrical Theory of Diffraction, Smooth Surface Diffraction, Boundary Element Method, Hybrid methods, Electromagnetic Scattering

This thesis is available online at:  