An experimental validation for the Incremental Theory of Diffraction

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Introduction

An antenna is located on top of a rectangular ground plate and is illuminated by another antenna, located in the far field. The goal of this work is to predict and measure the field received by the antenna mounted on the ground plate.

The Incremental Theory of Diffraction

This problem may be investigated using a ray-based theory. The contributions that need to be included are the direct ray and the rays diffracted by the edges and vertices of the ground plate. In this work, the Incremental Theory of Diffraction (ITD) will be applied because one purpose is to show how simple and advantageous its application is. The Incremental Theory of Diffraction was developed by Prof. Roberto Tiberio and his collaborators at the University of Siena, Italy [1], [2], [3], [4]. For practical purposes, the ITD provides a very simple mechanism to account for the contribution, at an observation point, due to the field scattered by an edge. Considering a scalar case, for the sake of simplicity, and referring to Fig. 1, at each point of the contour L the ITD defines an incremental diffraction coefficient $F(l)$. The quantity $F(l)$ represents an elementary contribution associated with an elementary length dl of the contour, which is usually irregular. By integrating all the elementary contributions around the contour L, the total field diffracted at P, due to the source S, is obtained. In particular, the ITD formulation accounts for the effects of edge diffraction and vertex diffraction. To this effect it is important to observe that the application of the ITD does not require the introduction of any special function, but all the appropriate diffraction mechanisms are accounted for through a simple numerical integration around the contour.

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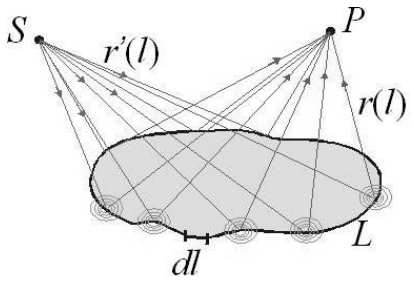

Figure 1: Field diffracted by the curved edge.

Conclusion

The major contribution of this work is to provide a case study for an experimental validation of the ITD, which to the best of the authors' knowledge was not previously accomplished. The measurements will be taken in the anechoic room at the University of Illinois at Chicago, at frequencies above 20 GHz.

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