Electromagnetic scattering from a curved faces wedge via the Parabolic Equation Method

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The Parabolic Equation (PE) method is a High Frequency technique for the evaluation of the diffracted field from wedge shaped region. It consists in a very efficient numerical solution of an approximate, Parabolic, differential equation derived from the original, Elliptic, Helmholtz equation. The Parabolic equation contains the slowly variable envelope of the diffracted field as unknown, and implicitly include the radiation conditions at infinity, hence allowing for a very efficient marching-in-space numerical solution.

The PE has shown to be able to treat very complex problems, as anisotropic impedance wedges (Pelosi, Selleri, Graglia, *IEEE Trans. Antennas Propagat*., 45(5), 1997) and even transparent wedges (Graglia, Pelosi, Selleri, *IEEE Trans. Antennas Propagat*, 49(12), 2001), as well as wedges with complex illuminations (Pelosi, Selleri, *IEEE Trans. Antennas and Propagat*., 47(10), 1999).

Being the method based on the scattered field alone, it can be applied only if the Geometrical Optics (GO) field is known and if a suitable starting point for the marching in space solution can be obtained. In this contribution the PE will be applied to a perfectly conducting wedge exhibiting curved, convex faces. This is a field of remarkable interest since many structures, like the edges of parabolic antenna reflectors, are better modeled with wedges delimited by curved faces than by wedges delimited by straight faces.

While in previous works the main issue was the computation of both the GO field and the starting conditions here the main issue lies in the domain shape. Straight faces wedge regions have, in a cylindrical reference centered on the edge of the wedge, a width in the ϕ co-ordinate which is constant with the distance from the edge ρ. This allows for a very easy numerical solution. In the problem at hand, on the contrary, the width in ϕ increases as a function of ρ, and greater care must be put into the numerical solution. The choice of convex wedge faces is bound to the need to avoid whispering gallery modes.

This work is supported in part by the Italian Ministry of University and Scientific Research under Grant MM09327718: "New analytical and numerical models of electromagnetic scattering and diffraction," and by the Microwave Engineering Center for Space Applications (MECSA) - Italy.