

Plane Wave Scattering by a Perfectly Conducting Rectangular Cylinder

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The problem of plane wave scattering by a perfectly conducting circular cylinder can be easily solved by representing the scattered field by an infinite series of Hankel-type circular cylindrical vector wave functions (J. VanBladel, "Electromagnetic Fields", Hemisphere Publishing Corp., 376-382, 1985). The orthogonality of the wave functions on the circular cylinder leads to a simple closed form solution for the scattered field amplitudes. In the case of a perfectly conducting rectangular cylinder, an integral equation formulation for the induced current on the cylinder was obtained (K.K. Mei and J. VanBladel, IEEE Trans. APS-11, 185-192, 1963). More recently, for the rectangular cylinder and Hankel-type scattered fields the translation addition theorem was used to convert them into Bessel-type fields on the cylinder surfaces (R.H. MacPhie, K. Ng and K. Ha Hau, Asia Pacific Microwave Conf. Proceedings, 81, 1997). The Bessel-type fields were then converted into rectangular coordinates for matching on the cylinder's 4 surfaces (R.H. MacPhie and K.-L. Wu, IEEE trans. MTT-43, 2041-2045, 1995).

In this paper we again represent the scattered electromagnetic field from the rectangular cylinder by the Hankel-type circular cylindrical vector wave functions. To convert these functions into rectangular (x, y, z) coordinates, we use the complex contour integral representation of the scalar functions (J.A. Stratton, "Electromagnetic Fields", McGraw-Hill, 367-369, 1941). The contour of integration C_2 is discretized into a finite sum (similar to that obtained for the Bessel-type functions) of complex exponential functions in rectangular coordinates. Then, the matching of the total incident and scattered fields is performed on the four sides of the cylinder and a matrix equation for the scattered field amplitudes is obtained. Numerical results for the square cylinder will be given.