Scattering by a Skew Trihedral Reflector

Piergiorgio L. E. Uslenghi
Department of Electrical and Computer Engineering
University of Illinois at Chicago, USA
uslenghi@uic.edu

A corner reflector consisting of three intersecting metal planes is considered. Two of the planes form an angle α between them that is in general different from the $\pi/2$ radians in a traditional trihedral reflector, whereas the third plane is perpendicular to the intersecting line of the first two planes. The primary field is a plane electromagnetic wave propagating in an arbitrary direction and with an arbitrary polarization. The analysis is conducted in the phasor domain with a time-dependence factor $\exp(+j\omega t)$ that is omitted throughout.

This boundary-value problem has been solved recently for an arbitrary value of the angle α (P.L.E. Uslenghi, IEEE Trans. Antennas Propag., vol. 63, no. 5, pp. 2228-2236, May2015). The technique consists in extending to oblique incidence the known solution of the two-dimensional problem of scattering by a conducting wedge in the MacDonald formulation, and then using the method of images to account for the third plane.However, this exact solution consists of an infinite series of products of Bessel functions of fractional order and trigonometric functions. In the present work, it is shown that a closed-form exact solution consisting of a finite number of plane waves is obtainable for values of $\alpha = \pi/n$, where n is any positive integer. The analysis is conducted separately for E- and H-polarizations of the incident plane wave (the general result for arbitrary polarization is easily obtained by superposition). The result obtained represents a novel closed-form exact solution to a scattering problem.