ABSTRACT

Approximate solutions are developed for the surface magnetic field on a magnetic current excited circular cylinder with an impedance boundary condition (IBC). These solutions are based on the assumption that the radius of the cylinder and the geodesic path length between the source and field points are electrically large. The proposed solutions are of practical interest in the analysis of mutual coupling between conformal slot antennas on a perfectly conducting (PEC) circular cylinder with a thin material coating. The material coated PEC surface can be approximated by an IBC which is valid in the limit of a thin coating.

First, a Uniform Geometrical Theory of Diffraction (UTD) based asymptotic solution is presented for the Green's function pertaining to the surface magnetic field on a circular cylinder with an IBC. Since this solution becomes less accurate within the paraxial (close to axial) region of the cylinder, an alternative closed form solution, which is called the paraxial solution, is proposed next to yield better accuracy for the Green's function within the paraxial region of the cylinder. The validity and accuracy of the numerical results for the approximate Green's function computed by the UTD based and paraxial solutions are demonstrated in comparison with those for the exact Green's function for which an efficient computation technique is developed as well. The numerical results reveal a robust criterion, which is useful in achieving a smooth transition between the UTD based and paraxial solutions.