Small Wavelength Approximations for Flat Strip and Cylindrical Wire Meshes

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Equivalent strip width is useful in modeling reflector antennas constructed of wire or strip meshes. In an earlier work (H. Rajagopalan *et al*, *IEEE Transaction of Antennas and Propagation*, 54, pp. 2845-2853, 2006), equivalent strip widths for some specific periodic arrays of cylindrical wire and strip meshes have been determined via experimental measurements and simulation. In this paper, an efficient method for calculating the equivalent width for (1) cylindrical wire meshes and (2) strip meshes is proposed, where the mesh dimensions are assumed small compared to wavelength.

The two-dimensional geometry of the infinitely thin strip mesh excited by a TE or TM wave is shown in Fig.1. Assuming the width of each strip is very small compared to the wavelength, the current density on each strip for TM and TE case can be written as $A/\sqrt{1-(x/w)^2}$ and $A\sqrt{1-(x/w)^2}$, where 'A' is a constant. The scattered field is expanded in terms of a Rayleigh series and the condition for zero electric field on each strip is imposed to determine the unknown coefficients. An approximate closed form solution for the insertion and return loss is determined based on the scattered field solution

The equivalent width of the cylindrical wire mesh or strip mesh is computed by considering a finite array of these elements, since the field near the central elements of the finite array is approximately equal to that of the field on the infinite array. The finite geometry is solved to obtain the current on each element. The algorithm is run iteratively until the current on the cylindrical wire or strip matches that of the infinitesimally thin strip. The computation time for this solution is found to be efficient and the computed results compare will with earlier published results.

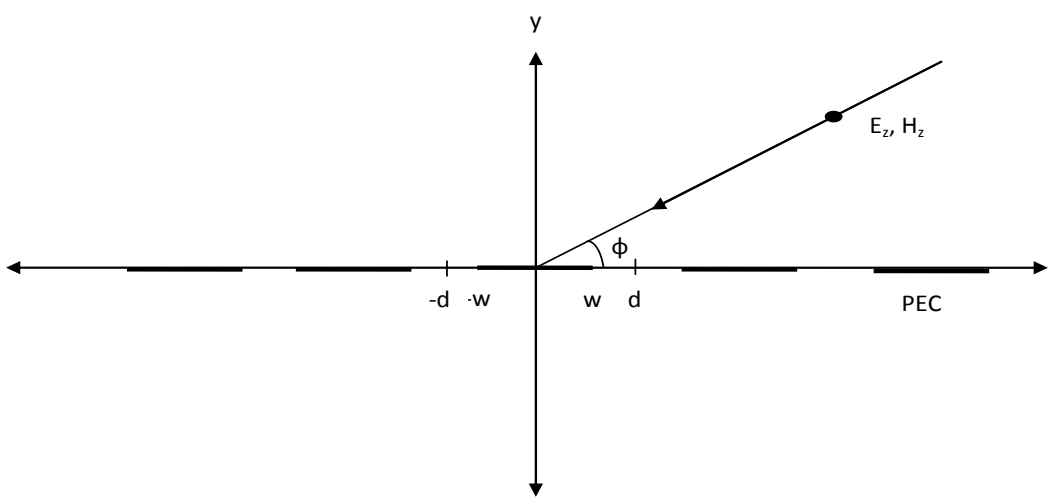

Fig.1. Plane Wave Incident on flat strip mesh.

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