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Journal of Electromagnetic Waves and Applications, Vol. 7, No. 3, 423–441, 1993

Analysis of Electromagnetic Scattering from Linear Periodic Arrays of Penetrable Bodies Using a Cylindrical Current Model

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Abstract–A novel solution is presented for the problem of three-dimensional electromagnetic scattering of a time-harmonic plane wave from an infinite periodic linear array of finite-sized homogeneous bodies. A set of fictitious sources comprising periodic and properly modulated cylindrical electric current sheets of dual polarization is used to simulate the scattered field. The field in the body region is approximated by the field of a set of elemental dipoles of dual polarization. The complex amplitudes of these fictitious sources are adjusted simultaneously to render the tangential components of the electric and magnetic fields continuous at a selected set of points on the surface of each one of the scatterers. The solution procedure is simple to implement and is applicable to linear periodic arrays composed of disjoint bodies of smooth, but otherwise arbitrary, shape. The accuracy of the method has been demonstrated. It has also been shown that in the limiting case of widely spaced spherical scatterers the results of our numerical solution agree with results obtained by an approximate analytic solution.