An Axial, 2D Periodic Dielectric Lattice That Extinguishes Bistatic Scattering in All Directions at a Single Frequency

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Consider a TM harmonic electromagnetic wave in free space incident upon a linear, isotropic, non-magnetic material cylinder of infinite length and arbitrary transverse cross-section. The cylinder may be inhomogeneous with respect to transverse coordinates. Subdividing the cross-section of the cylinder into discrete elements, the method of Dr. J. H. Richmond [IEEE Trans. Antennas & Propagation, vol. AP-13, May 1965] may be applied to solve a linear equation to obtain the electric field within each element of the cylinder, which may then be used to calculate the scattering pattern.

Using principles of Mach-Zender interferometry, a 2D periodic dielectric lattice was designed which matches the optical path lengths of radiation within alternating elements to equal an integral number of half-wavelengths in each of two different dielectric materials at a single frequency. Numerical results obtained using Richmond's method demonstrate that for a unit magnitude incident electric field, this lattice extinguishes bistatic scattering along the interferometric axis for incidence normal to the axis, and extinguishes bistatic scattering in all directions when incidence is coaxial. The method of lattice design, computational analysis, and the scattering results will be presented and discussed.