TE AND TM MODAL DISPERSION IN CYLINDRICAL LOSSY TERAHERTZ METAMATERIAL WAVEGUIDE

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ABSTRACT

In this work, we derive the TE and TM modal dispersion relation for a cylindrical waveguide with dielectric core and two classes of Terahertz left-handed material were used. The first class uses 3D nano-spheres distributed in loops in the dielectric host material, which gives rise to negative effective permeability and permeability at Terahertz (optical) frequencies. The second class is the nanorods that result in negative effective permeability and permeability at optical frequencies used in communications. We numerically solved the modal dispersion relation, and the power confinement for Terahertz TE and TM modes for a given set of parameters including operating frequency, core's radii, and power confinement factor and extinction coefficient. We found that the real and imaginary (extinction coefficient) parts of the effective refractive index exhibit small values. Besides that, the power confinement in the dielectric core increased as core's radius increased and the power attenuation deceased as core's radius increased.

KEYWORDS: Cylindrical Waveguide, Dispersion Relation, Left Handed Material LHM Surface Waves, Power Confinement