Abstracts

Planar negative refractive index media using periodically L-C loaded transmission lines

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Recent demonstrations of negative refraction utilize three-dimensional collections of discrete periodic scatterers to synthesize artificial dielectrics with simultaneously negative permittivity and permeability. In this paper, we propose an alternate perspective on the design and function of such materials that exploits the well-known L-C distributed network representation of homogeneous dielectrics. In the conventional low-pass topology, the quantities L and C represent a positive equivalent permeability and permittivity, respectively. However, in the dual configuration, in which the positions of L and C are simply interchanged, these equivalent material parameters assume simultaneously negative values. Two-dimensional periodic versions of these dual networks are used to demonstrate negative refraction and focusing; phenomena that are manifestations of the fact that such media support a propagating fundamental backward harmonic. We hereby present the characteristics of these artificial transmission-line media and propose a suitable means of implementing them in planar form. We then present circuit and full-wave field simulations illustrating negative refraction and focusing, and the first experimental verification of focusing using such an implementation.

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