Imaging by a double negative metamaterial slab excited with an arbitrarily oriented dipole

The imaging capability of nonideal double negative metamaterial slabs excited by arbitrarily oriented electric or magnetic dipoles is investigated. A dipole oriented parallel to the interface of the slab excites transverse electric and transverse magnetic modes simultaneously, which are transmitted unequally by the slab if either the slab's relative permittivity (εr) or permeability (μr) or both are perturbed from the ideal case, i.e., εr=μr=−1 for a slab in vacuum. Approximations in the electrostatic limit, valid for modes with large wave numbers, fail to predict this phenomenon, and more accurate analysis of the field distribution in the vicinity of the image plane behind a nonideal slab becomes important. By expressing the fields in terms of a one-dimensional Hankel transform in the spectral domain and using an adaptive Gauss-Kronrod quadrature, a tool for evaluating the spatial field intensity in the vicinity of the image plane behind the slab is developed. The calculated field intensities reveal that a double negative slab does not focus in the three-dimensional space and is only capable of two-dimensional imaging.

Stichworte: metamaterial; superlens; imaging; dyadic Green's function

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