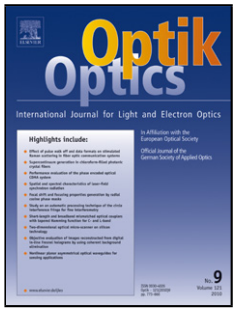

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FRACTIONAL SPACE ANALYSIS OF OPTICAL REFRACTION IN SILVER

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Abstract

Silver metal is known to share some of the peculiar features of meta-materials in optical frequency domain. In this article, we investigate the occurance of negative and/or orthogonal phase velocity, negative refraction and counterposition phenomena in silver with fractional dimensions. For this purpose an interface of free space and silver metal is considered for various values of fractional dimensions of both the half spaces. The observed values of the refracted poynting vector relate to the occurance of the above mentioned phenomena. It is noted that although the fractionality of either of the half space does not alter the occurance of the said phenomena, the absolute values of the refracted poynting vector vary greatly with a change in the fractionality of dimensions, indicating a possible control of energy flow in refracted fields via fractional parameters.

1 Introduction

In optics, refraction, the bending of light from edges is one of the oldest subjects. A persistent investigation in this subject has led to the discovery of various interesting phenomena, namely, negative refraction, counterposition, orthogonal phase velocity and negative phase velocity, pertaining to refraction from various kind of materials and geometries [1-7]. When phase velocity $\mathbf{V}_p$ and time averaged Poynting vector $\mathbf{P}_{av}$ orient with respect to each other in such a way that $\mathbf{V}_p.\mathbf{P}_{av} > 0$, $\mathbf{V}_p.\mathbf{P}_{av} < 0$,$\mathbf{V}_p.\mathbf{P}_{av} = 0$ then positive, negative and orthogonal phase velocities result in the medium, respectively. Negative refraction, first introduced by Vaselago [7], is reverse of ordinary refraction in the sense that incident and refracted fields remain on the same side of the normal to a planar interface. The phenomenon of counterposition, on the other hand, takes place when real part of refracted wave vector and the corresponding time-averaged Poynting vector are positioned on opposite sides of the normal to the planar