Sivuchin Prodlem and left-anded media

Veklenko B.A.

JIHT. Moscow. Russia. VeklenkoBA@yandex.ru

Whether it is possible to have the electromagnetic waves with opposite directed phase and group velocities (left handed media). For non-isotropic media and for the media possess the space dispersion the answer is positive. In 1957 year D.V.Sivuchin [1] paid attention to the fact that the answer may be positive and for homogeneous isotropic media without space dispersion if at any frequencies such media simultaneously possess the negative as permittivity  and permeability  (Sivuchin media). The question about existence of such media as a solid state, gas or plasma Sivuchin rests open. Such media were investigated by V.G.Veselago [2,3]. Veselago took attention at optics anomalies in such media which seemed be found the experimental approving [4,5].

Process of Fresnel reflection of electromagnetic wave by homogeneous isotropic medium without space dispersion is investigated. The investigation is performed using Maxwell equations and causality principle. It is shown that this problem possesses the only one solution. This solution corresponds to the positive value as permittivity and permeability if such functions are used for description the properties of refracted medium. If the investigation is made using the Maxwell equations for substances and the bound conditions following from these equations then two solutions of problem appear. One of them corresponds to the positive values and  while another one corresponds to their negative values (Sivuchin media). The second solution has to be omitted as controverting the causality principle. In such a way the Sivuchin problem is solved. The experimental results may be approximated by Sivuchin media only on phenomenological level.

References

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