The Mathematical Modeling of Process of Light Propagation in Liquid Crystal Planar Structures With Changing of Refraction Coefficient

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Abstract – **This work are dedicated to the mathematical modeling of process of light propagation in liquid crystal planar structures with changing of refraction coefficient**

Keywords – **refraction coefficient, mode structure.**

I. INTRODUCTION

The liquid crystal materials have a wide using as active medium of displaying and processing of information. But in prevail majority of such devices the light propagation in perpendicular direction to the liquid layer are used. Such liquid crystal properties as anisotropy of refraction coefficient and sensibility to internal electrical field is permit to design the planar electrical controlled waveguide structure with changeable of refraction coefficient. But the process of light propagation in medium with changeable of refraction coefficient are not enough studied for the designing such devices. The computer modeling of propagation process in planar structures with changeable of refraction coefficient are carried out.

II. MODELING

The modeling of beam propagation in liquid crystal cell with gradient of refraction coefficient is carry out by using Zemax software. For the modeling process the layer model with distribution of refraction coefficient are created. This model must indicate the real distribution at the edge conditions and at the electrical field influence. This task is solved by means of the creation corresponding dynamic libraries (Dynamic Link Library). These libraries the distribution function are described. We create the model of distribution for next real textures: planar oriented cholesteric liquid crystal, hybrid nematic texture, planar nematic texture with positive dielectric permeability in internal electrical field.

At the modeling process of light propagation the next initial condition are used. The change of refraction coefficient of liquid crystal layer realized only in plane is perpendicular to the way of light propagation. The wave effects are not taking into consideration. The general scheme of modeling is shown on figure 1.

As the result of modeling the distribution of radiation intensity after propagated through the modeled structure are obtained (Fig 2).

As shown from dependencies the changing of distribution character of refraction coefficient in liquid crystal layer leads to the changing of distribution of intensity outgoing radiation. Such character of these dependencies the changing of mode structure are explained.

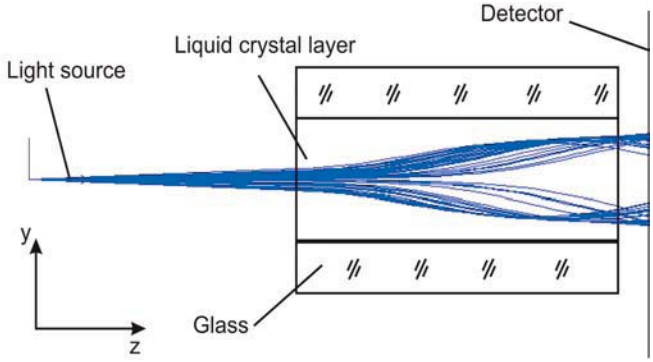

Fig.1. The general scheme of modeling of light propagation in layer with changeable of refraction coefficient

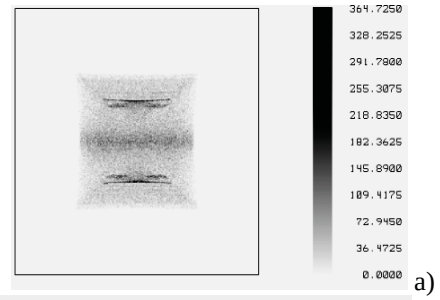

Fig.2. The distribution of intensity outgoing radiation at the different distribution of refraction coefficient: a) planar oriented cholesteric liquid crystal texture; b) hybrid nematic texture

III. CONCLUSION

The mode structure of outgoing radiation is determinate basically by character of distribution of refraction coefficient in liquid crystal layer. The obtained distribution of radiation intensity may be useful to use for the real determination of distribution of refraction coefficient in planar waveguide structures.

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