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THE DIFFUSE RADIATION PROPAGATION THROUGH A LAYERED STRUCTURE

In the framework of the given article we found the analytical expressions for the transmission and reflection coefficients of an electromagnetic radiation propagating non-coherently through a one-dimensional layered structure.

Keywords: electromagnetic radiation, non- coherent transmission.

The problem of a wave motion description in the volume of a multilayered structure due to the importance of the practice application and the great theoretical interest always attracts close attention. It is known, that in the base of any wave motion, lies the transmitting mechanism of a wave perturbation appearing in a one-space point to its neighboring points. Depending on the media properties, the transmitting mechanism of the wave perturbation can differ. The mentioned fact is reflected in a certain way in the form of the corresponding wave equation. The theory describing the process of coherent transmission of the wave perturbation from point to point of a media is called the wave theory.

At the same time, very often, it is necessary to consider the situations, when the perturbation transferring mechanism is very confusing and complex and various random factors are involved in it. In such cases, there is no connection between the phases of waves reemitted by different areas of the media. In other words, the perturbation existing in one point is transmitted to the points close to it, but the transmitting process has no determinate character, it has a random nature. So, any elemental volume of the media is under the action of a random force, which is formed as a result of superposition non-coherent waves coming to the considered volume from the other parts of the media. Moreover, in some cases, the properties of the media can endure strong fluctuations and take a nonlinear character, which brings to the reconstruction of the spectral composition of a wave process.

We come across the problems of the above described character in astrophysics, applied optics, geophysics, biophysics, nuclear physic, etc. [1-6]. The theory describing the process of non-coherent transmission of the wave perturbation in a media volume is called the transfer theory. The main difference between the wave theory and the transfer theory appears in the approaches to the wave process description. If in the first case, the wave process is given by means of the wave field or the wave field amplitudes, in the second case, the wave process is described in the energy terms like intensification, brightness, etc. It is important to note that in the case of a non-coherent wave process, the transition to the energy description does not mean that the energy pumping from one area of the media to another occurs deterministically.

The wave radiation transmission through the one dimensional structure consisting of a finite number of arbitrary layers is considered. To determine the transmission and reflection coefficients T_N and R_N one should use the following set of finite equations:

$$T_N = \frac{T_{N-1}t_N}{1-R_{N-1}r_N},\ R_N = R_{N-1} + \frac{T_{N-1}^2 r_N}{1-R_{N-1}r_N}, \tag{1}$$

where t_N and r_N are the transmission and reflection coefficients of the n-th layer of the structure. This set of equations should be considered in accordance with the following initial conditions:

$$T_0 = 1,\ R_0 = 0. \tag{2}$$

In the general case, the problem **Error! Reference source not found.**, **Error! Reference source not found.** can be solved numerically only. However, in the case of an ideal structure, when all the layers are identical, i.e. for an arbitrary $j\,(j = 1, 2, \cdots, N)$

$$t_j = t \text{ and } r_j = r. \tag{3}$$

It is easy to check that when $t_N + r_N = 1$ and $T_{N-1} + R_{N-1} = 1$, then

$$T_N + R_N = 1. \tag{4}$$

This equation corresponds to the flax conversation law. By introducing the quantities

$$Q_N = 1/T_N,\ P_N = R_N/T_N\ (Q_N - P_N = 1), \tag{5}$$

the set of Eqs. **Error! Reference source not found.** can be presented in a linear form:

$$Q_N = \frac{1}{t_N}Q_{N-1} - \frac{r_N}{t_N}P_{N-1},\ P_N = \frac{r_N}{t_N} + P_{N-1}, \tag{6}$$

the intitial condition $R_0 = 1,\quad Q_0 = 0$. For an ideal structure (see **Error! Reference source not found.**) one can get:

$$T_N = \frac{t}{t+Nr},\ R_N = \frac{Nr}{t+Nr}. \tag{7}$$

As it is seen from the last result when $N \to \infty$, then $T_N \to 0$ and $R_N \to 1$.

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ԴԻՖՈՒԶ ՃԱՌԱԳԱՅԹՄԱՆ ՏԱՐԱԾՈՒՄԸ ՇԵՐՏԱՎՈՐ ՀԱՄԱԿԱՐԳՈՒՄ

Աշխատանքի շրջանակներում միաչափ շերտավոր կառուցվածքով անցնող էլեկտրամագնիսական ճառագայթման անցման և արտացոլման գործակիցների համար գտնվել են անալիտիկ արտահայտություններ:

Առանցքային բառեր. էլեկտրամագնիսական ճառագայթում, ոչ կոհերենտ տարածում:

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РАСПРОСТРАНЕНИЕ ДИФФУЗНОГО ИЗЛУЧЕНИЯ ЧЕРЕЗ СЛОИСТУЮ СТРУКТУРУ

В рамках данной статьи найдены аналитические выражения для коэффициентов прохождения и отражения электромагнитного излучения, распространяющегося некогерентно через одномерную слоистую структуру.

Ключевые слова: электромагнитное излучение, некогерентное распространение.