Radioelectronics and Communications Systems
Vol. 47, No. 3, pp. 29–31, 2004

Izvestiya VUZ. Radioelektronika
Vol. 47, No. 3, pp. 43–46, 2004
UDC 583.874

DIFFRACTION OF ELECTROMAGNETIC WAVES ON A SHUTTER RESISTIVE PERIODIC STRUCTURE WITH MULTILAYER PERIODIC INCLUSIONS

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An algorithm is suggested permitting us to consider the impact of magnetodielectric filling on the scatter-absorption properties of periodic diffraction lattices of the “shutter” type made with resistive materials. The paper gives dependencies of the power reflection factor on the wavelength for spatial modes at different values of permittivity of the dielectric filling.

Diffraction lattices made of resistive strips, which are widely used in antennas, optical devices, and radar masking of armaments and military equipment, are often surrounded by magnetodielectric layers. This makas it possible to put thin resistive strips into a required shape and to stiffen the whole structure. Insertion of materials with particular electrophysical properties into dielectric may improve scattering characteristics of the periodic structures under consideration. In these cases we have to take account of the impact of magnetoelectric filling on scattering-absorption properties of the diffraction lattices. One way to do this is to use the known method of generalized scattering matrix [1].

Assume that a plane wave with a single nonzero component of the field intensity vector (this component is parallel to the lattice fins) falls at some angle α onto a shutter-type resistive lattice with its period l. The lattice is embedded in a magnetodielectric layer with parameters $\varepsilon = \varepsilon_1$, $\mu = \mu_1$. The magnetodielectric structure of thickness h_1 is located above this layer (Fig. 1). Our goal is to find the scattered field.

It is known [2] that the infinite (in general case) matrix of complex amplitudes of the field U scattered by the lattice can be replaced by a finite-dimensional matrix and be written as follows:

$$U = \begin{bmatrix} 0 \\ \vdots \\ R_0^{011} \\ \vdots \\ 0 \end{bmatrix} + \begin{bmatrix} T_{-s}^{110} & \dots & 0 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & T_0^{110} & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & 0 & \dots & T_s^{110} \end{bmatrix} \begin{bmatrix} a_{-N,-S} & \dots & a_{-N,0} & \dots & a_{-N,S} \\ \dots & \dots & \dots & \dots & \dots \\ a_{0,-S} & \dots & a_{0,0} & \dots & a_{0,S} \\ \dots & \dots & \dots & \dots & \dots \\ a_{N,-S} & \dots & a_{N,0} & \dots & a_{N,-S} \end{bmatrix} \times$$

$$\times \left(\begin{bmatrix} 1 & \dots & 0 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & 1 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & 0 & \dots & 1 \end{bmatrix} - \begin{bmatrix} R_{-s}^{110} & \dots & 0 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & R_0^{110} & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & 0 & \dots & R_s^{110} \end{bmatrix} \times \begin{bmatrix} a_{-N,-S} & \dots & a_{-N,0} & \dots & a_{-N,S} \\ \dots & \dots & \dots & \dots & \dots \\ a_{0,-S} & \dots & a_{0,0} & \dots & a_{0,S} \\ \dots & \dots & \dots & \dots & \dots \\ a_{N,-S} & \dots & a_{N,0} & \dots & a_{N,-S} \end{bmatrix} \right) \times \begin{bmatrix} 0 \\ \vdots \\ T_0^{011} \\ \vdots \\ 0 \end{bmatrix}$$

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20 June 2003