

Volume Singular Integral Equations Method for Solving of Diffraction Problem on Dielectric Body Located in Rectangle Resonator

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The three-dimensional time-harmonic problem of diffraction of incident electromagnetic field on anisotropic dielectric body Q in the rectangular resonator P is considered. The boundary of resonator is perfectly conducting. The body Q , located in P is characterized by real positive tensor permittivity $\hat{\varepsilon}$ and constant permeability μ_0 . Outside Q media is characterized by constant permittivity ε_0 and constant permeability μ_0 . The components of permittivity have a jump at the boundary of Q . The surface of body Q is piece-wise smooth, i.e., conical and corner points are available.

The mathematical statement of the problem is stated in terms of generalized boundary-value problem for the system of Maxwell equations. Fields E and H are found in space $L_2(P)$. Maxwell equations as well as boundary conditions on perfectly conducting surfaces are considered in distributional sense. For nonresonant frequencies the existence and uniqueness of solutions of the boundary value problem are proved.

The method of volume integral singular equations is applied for solving of the problem. Using the tensor Green function of parallelepiped new integral equations are presented. The properties of Green's function are investigated. The constructive method of extraction of singularity of Green's function is suggested and numerically tested. The equivalence of differential and integral problems is proved. The existence and uniqueness of solutions of the volume integral singular equations in $L_2(Q)$ are proved.

Galerkin method is used for numerical solution of integral equations. Splines of low order are applied as basic and test functions in Galerkin method. The explicit expressions for augmented matrix are written. The convergence of Galerkin method is proved for a wide class of dielectric bodies.

The numerical experiments were carried out using parallel programming for multiprocessor computers. Method of parallel computations for solving of integral equations is presented. Numerical and graphical results for some anisotropic dielectric bodies with real and complex permittivity ε are also presented. Analysis of parameters of electromagnetic fields in microwave oven is the example of practical application of these results.

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