EIGEN FIELD AND EIGEN FREQUENCIES CALCULATION BASED ON THE METHOD OF AUXILIARY SOURCES

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The paper deals with the determination problem of the voluminous electromagnetic resonators' Eigen resonant frequencies and resonant fields. This topic is related to the general problem of the Eigen functions and Eigen values and represents its one particular electromagnetic case.

Voluminous electromagnetic resonator represents an object, which has the ability at the Eigen frequencies (and its vicinity), as a result of the resonant phenomena, accumulate the energy of the electromagnetic field. Such devices have wide application in the modern electronic devices and high frequency radio- engineering. That's why it is very important to work out the general approach to determine their Eigen frequencies and fields.

Solution of this problem using analytical methods is possible only for resonators with very simple geometry. In case of the complicated geometry it is possible to use only numerical methods.

In the mathematical formulation [1] we look for the function, which satisfies the $\hat{L}f = Lf + \alpha f = 0$ operator equation in the given area and the homogenous $\hat{W}f\big|_{\Gamma} = 0$ boundary condition on its boundary. This problem has nontrivial solution which is called the Eigen function of the L operator and exists only for Eigen values of the α coefficient. If we expand the nontrivial solution in the $\hat{L}$ operator's fundamental solution classes, then using the boundary condition we will get the linear homogenous equation system for the unknown coefficients. The existence of the nontrivial solution for this system requires that its determinant must be zero, which represents the transcendent equation for the α Eigen functions. The numerical realization of this approach is related to some difficulties.

In the physical point of view on the selected resonator the diffraction problem is solved and then we look for the values of the incident wave frequency to which corresponds to the maximal reradiated power. In the paper it is shown that this approach is very efficient.

References

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