Lvovich Ya.E., Lvovich I.Ya., Preobrazhensky A.P., Choporov O.N.

THE SUBSYSTEM FOR ANALYZING SCATTERING CHARACTERISTICS OF CAVITY STRUCTURE IN OBJECT

Lvovich Ya.E., Russia, Voronezh Institute of High Technologies
Lvovich I.Ya., Russia, Paneuropean University
Preobrazhensky A.P., Russia, Voronezh Institute of High Technologies
Choporov O.N., Russia, Voronezh Institute of High Technologies

Abstract
In the paper we consider the problems of scattering of electromagnetic waves on cavity structures in the object. The algorithm based on the integral equations is used. The structure of subsystem for predicting scattering characteristics of object is given.
Keywords: Propagation of electromagnetic waves, diffraction, integral equation

Introduction
Cavity structures can be a part of various technical objects [1, 2]. When considering the processes of scattering of electromagnetic waves, often it appears that the contribution to a secondary electromagnetic field from cavity structures can be comparable, and sometimes more, than a contribution from all analyzed object [3, 4].

There is a number of problems in which the cavity is formed in the object having rather simple form [1].

The aim of this paper is the analysis of scattering characteristics of some objects, containing cavity structures.

Technique
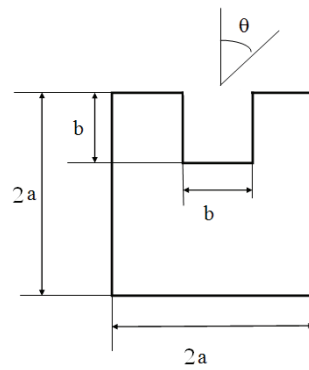In figure 1 the example of object which we suggest to analyze is given.

Figure 1. The scheme of scattering of electromagnetic
waves on object

The calculation of characteristics of electromagnetic waves was carried out on the basis of a method of the integral equations [1]. The integral equation was solved by method of the moments with piecewise and continuous basic functions.

The dependence of the radar cross section (RCS) is given in figure 2. The extent of object was the following: $a=4,5\lambda$, $b=3\lambda$ Curve $1 - b=\lambda$, a curve $2 - b=2\lambda$, a curve $3 - b=3\lambda$.

The dependence of average RCS is given in figure 3. The extent of object was the following: $a=4,5\lambda$, $b=3\lambda$ Curve $1 - b=\lambda$, a curve $2 - b=2\lambda$, a curve $3 - b=3\lambda$.
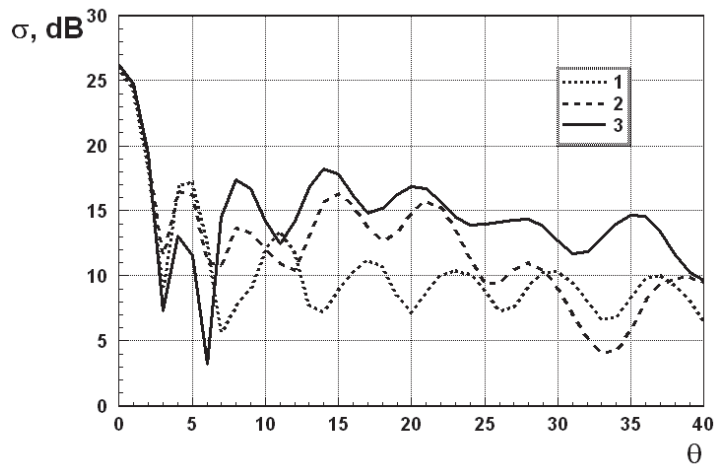

Figure 2. Calculation of scattering characteristics of Object

The analysis of charts of the return dispersion shows that for RCS the coincidence is observed in very narrow sector of angles 0-5°. For other sector of angles the distinction between scattering characteristics can reach 10 dB. Thus RCS of object owing to diffraction effects considerably changes from a supervision angle. For average RCS of object the change for the same sizes with increase in increasing an angle of observation and the value of this change is not more than 1db. Thus average RCS at the change of the sizes of object changes at the same value about 2 dB.

With use of the specified approach the algorithm of predicting of characteristics of dispersion depending on various parameters of object – width and depth of a cavity, the extent of object, etc. can be developed.
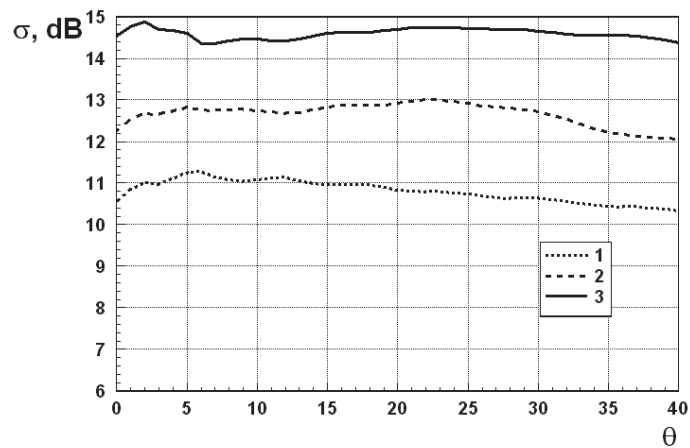

Figure 3. The calculation of average scattering characteristics of object

In figure 3 we can see the structure of subsystem for predicting scattering characteristics of object. The corresponding algorithms can be used in systems of design of technical objects and means of a radio communication [1, 5].
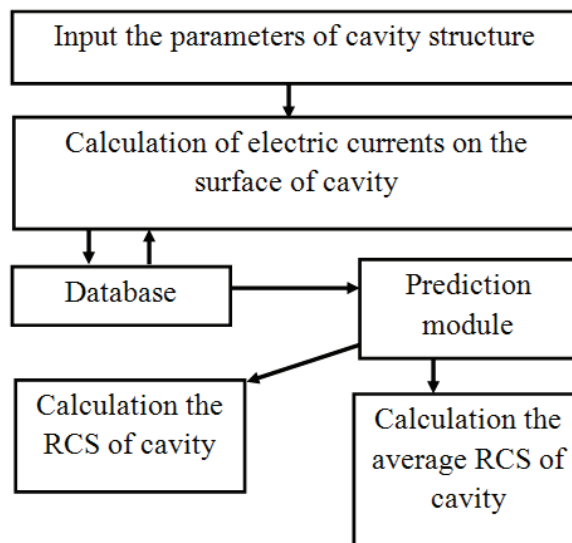
Figure 4 The structure of subsystem for predicting scattering characteristics of object

Conclusion

In the paper the modeling of scattering of electromagnetic waves with use of a method of the integrated equations on the cavity structure which is a part of object is carried out. On the basis of the analysis of rated average scattering characteristics there is an opportunity for a certain group of parameters to create the algorithm allowing to predict values of scattering characteristics. The structure of subsystem for predicting scattering characteristics of object is given.

References

[1]. Preobrazhensky A.P. Modelling and algorithmic analysis of diffraction structures in CAD of radar antennas / Monography VIVT; RosNOU. - Voronezh: Scientific book, 2007. - 248 p.

[2]. Lvovich I.Ya., Preobrazhensky A.P., Choporov O.N. The construction of subsystem for designing of scattering of scattering of hollow structures with coatings / 2d the International Scientific-Practical Conference on the Humanities and the Natural Science ISPC 2014, pp.21-24.

[3]. Golovinov S.O., E.A. Kruglyakova, Preobrazhensky A.P. The development of algorithm for estimation of the characteristics for complex objects using the method of

edge waves / The Bulletin of the Voronezh Institute of high technologies. 2007. Vol. 1. N. 1. pp. 25-27.

[4]. Golovinov S.O., E.A. Kruglyakova, Preobrazhensky A.P. The algorithm for estimating the characteristics of the scattering of complex objects using the method of edge waves / Territory of science. 2006. N. 1. pp. 56-59.

[5]. Lvovich Ya.E. Multi-optimization: theory and applications / Voronezh, Kvarta, 2006, 415 p.