

The Improving of the Radar Detection System under the Influence of External Actions

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Abstract - In this paper we consider the possibility of an improvement of the characteristics of detection system due to a priori analysis of the unfavorable influence on the mathematical models.

Keywords - Radar detection system, Antenna, External influence, Mathematical models.

I. INTRODUCTION

The antenna is one of the most important elements in the radar detection system, which is in direct contact with the environment and is exposed to the unfavorable influences.

Due to the deformation of parabolic reflector antennas which are used in radio beam detection systems, as a result of such influences, the spatial amplitude-phase distribution of excitation sources is changed. The radiation pattern and the directivity factor are also changed. For the microwave range even small deviations are important. This influences a lot on the parameters of the detection system on the whole. However, for more exact estimates of this effect it is necessary to build a special electrodynamic model that takes into account the specification of the construction.

II. ANALYSIS OF REPOSITORIES

To improve the effectiveness of the radar detection system it is necessary to manage the system parameters, taking into account the real effects of the environment and the results of an a priori analysis of these effects on mathematical models in the process of construction. At the same time during the exploitation of the system it is necessary to control the environmental parameters. The researches of the systems that use the parabolic reflectors [2, 3] in the antennas showed that the greatest influence on their characteristics provides the ambient temperature. That is why data of the ambient temperature and the reflector at the control points could let us get the information about the behavior of the reflector in the concrete conditions and their corresponding characteristics of the radiation antenna. This gives an opportunity to adjust the making of the decision in the detection systems, taking into account the results of calculations which were received using the proposed mathematical model for specific operating conditions. This will also help to avoid the seasonal adjustment. A necessary condition for the functioning of such scheme is the available information about the characteristics of the antenna radiation in the concrete conditions of its exploitation. Such information may be obtained at the design stage in the process of investigation of the influence of the external factors on the characteristics of the antennas using mathematical models and experimental data.

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This mathematical model can be constructed using the finite elements in the form of tetrahedral, the corresponding vertices of which coincide with the nodes of the electrodynamic model of the radiating surface. This allows to take into account the influence of the antenna surface distortion on its radiation patterns. The components of the total radiation field are obtained by a simple summation of spherical component of the field of each finite element and boundary edges of each edge of the radiating surface of the antenna regarding to the global coordinate system taking into account their vector character.

Since the entire set of the studies represents a difficult task and the existing software packages do not allow to make all the necessary research, the data about the deformation of the surface of the antenna is obtained with the help of the usage of one of the computer-aided design and the engineering analysis. The radiation characteristics of the deformed antenna were evaluated using the proposed electrodynamic model [3]. The obtained results correspond to the well-known theoretical and experimental data. This indicates that it is possible to use the proposed mathematical models in practice.

III. CONCLUSION

Thus it is actual create the intelligent radar systems which can accounting to data about the environment and the results of an a priori analysis of the behavior of the antenna in the current operating conditions, control the parameters of the system, so that to ensure the functioning with the required characteristics.

REFERENCES

- [1] Yakimov A.N. Design of microwave antennas, taking into account external influences: a monograph. - Penza: Penza State University Press, 2004. – 206 p.
- [2] Gorbalysov M.S., Yakimov A.N. Analysis of the characteristics of the radio beam detection system. / New industrial technologies. - 2010, № 6. - pp. 35-37.
- [3] Gorbalysov M.S., Yakimov A.N. Simulation of thermal effects on the characteristics of antenna and radio beam system. / Reliability and Quality: Proc. Sympos. - Penza: Penza State University Press, 2011. - Vol.1. - pp. 287-289.