B. Ruban, Master student
D. Poleshchuk, Master student
V. Tsyporenko, PhD in Engr., As. Prof., research advisor
A. Danylchenko, lecturer, language advisor
Zhytomyr State Technological University

OPTIMIZATION OF THE NON-SEARCH DIGITAL METHOD OF CORRELATION-INTERFEROMETRIC DIRECTION FINDING

In nowadays automated systems of radio-monitoring, the direction finding of radio-electronic means is carried out under conditions of the complex electromagnetic environment, a great a priori uncertainty as to the parameters of radio frequencies, as well as in a timescale realization [1, p. 475].

Correlation-interferometric direction finding is usually implemented by the search compensatory method. The disadvantage of this method is large time or hardware consuming. The effectiveness of the directionfinding mechanisms is significantly determined by the ratio of their accuracy, speed, noise immunity and corresponding hardware losses. Therefore, the development and optimization of the high-speed digital correlation-interferometric radio direction equipment, which performs a direct correlation estimation of the direction on the source of radiation with the use of digital processing of complex spectra of the received mixture of radio frequencies, is an actual scientific aim [1, 2].

The purpose of the study is to research and optimize the non-search digital method of the correlation-interferometric direction finding with the reconstruction of the spatial analytical signal [3].

The analysis of peculiarities of realization and accuracy of the investigated method of the direction finding, as well as analytical optimization of the non-search digital method of correlation-interferometric bearings with reconstruction of the spatial analytical signal is studied; which of the parameters included in the equation of the error of estimation of the direction of the source of radio emission for a non-search digital method of correlation-interferometric direction finding with the reconstruction of the spatial analytical signal are to be optimized is determined.

It is shown that the main parameters that are appropriate to optimize are the values of diversity between the selected elements of the array antenna, for the spatial positions of which the reconstruction of a complex analytical signal is carried out, their numbers, as well as the value of the spatial weight function of the window, that determine the method of implementation of the procedure for reconstructing a complex analytical signal.

The theoretical optimization of the parameters of the investigated method, as well as the comparative analytical calculations with the results of modeling, was carried out. As a result of the simulation, the dependence of the methodical error of the bearing estimation and the mean square bearing evaluation on the action of normal Gaussian noise from the values of optimized parameters is obtained.

In order to optimize the parameters of the studied method, the form of the target and communication functions is determined; an analysis of the features of the optimized bearings method implementation is performed.

Analysis of the equation for the dispersion of the error of direction finding essentially depends on the method of a complex analytical signal reconstructing procedure within the aperture of the antenna array. In this case, the parameters of the directionfinder, as the number Z directional radio channels of the antenna array, their bandwidth of the analysis, radio channels and sensitivity have significant constraints in optimizing, taking into account the possibilities of modern technical implementation and requirements for compactness and price of the bearer.

Such parameters as spatial weight functions of the window, amount of signal group are determined by the requirements for impedance protection in the conditions of the complex electromagnetic environment to provide effective frequency and spatial selection of station noises and re-reflection obstacles.

Therefore, their variation is also substantially limited in order to optimize the noise immunity of the banding.

The radiation parameters of the incident source, such as the average or carrier frequency of the time energy spectrum and the direction the arrival of radio emission on the paging algorithm, in turn, is not affected and only the global constraints on the range of operating frequencies and the width of the directional sector are limited.

Duration of the radio emission analysis process, taken simultaneously within the band of analysis frequencies radio channels, significantly affects the noise immunity and the speed of the bearings, but does not affect the implementation of the algorithm as a whole and the procedures for reconstructing the complex analytical signal.

Conclusions. The theoretical optimization of the parameters of the investigated method is carried out and the appropriateness to use the symmetric spacing z = 28 in order to minimize the error of the estimation of the direction of error on the source of radiation and to ensure the maximum accuracy of the positioning is determined.

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