THE GENERALIZED INDETERMINACY FUNCTION OF A SPACE-SURFACE BISTATIC RADAR SYSTEM WITH SYNTHETIC APERTURE OF THE TRANSMITTER

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The paper is devoted to analysis of spatial resolution of a bistatic space-surface radar system with synthetic aperture of the transmitter. The system is shown to be able to measure two out of three coordinates of a target. Most natural for the measurements are target’s range $R$, which is evaluated based on the delay time of the received signal, and the projection $x$ of the target radius vector on the direction of satellite’s trajectory, when the projection is measured by the Doppler shift of the received signal frequency. Formulas for the resolving capacity in terms of both these parameters are derived.

The advancement of radiolocation during the last few decades took place against the background of tightening requirements for the major characteristics of radar systems [1, 2]. Despite considerable progress in components and devices used in radar equipment, often we cannot meet these growing requirements within the framework of traditional radar design [2]. One promising solution in this field is a so-called bistatic radar with its transmitter placed on a satellite, and the receiver located on (or near) the Earth’s surface. Then, because of the satellite motion, we can implement the transmitter aperture synthesis. In the English-language literature such systems are called SSBSAR (Space-Surface Bistatic Synthetic Aperture Radar) [3].

One of the major characteristics of any radar system is its spatial resolution. In traditional radar systems information on the spatial resolution is obtained from analysis of the indeterminacy function of the signal processed [4], also called the error function [5]. The theory of synthetic aperture radar (SAR) usually recommends evaluating the resolution through analysis of a so-called function of point diffusion (blurring) [6]. The use of the signal indeterminacy function for analysis of SAR resolution is infrequent [7].

The purpose of this work is to derive analytical expressions for the generalized indeterminacy function of the processed signal from a space-surface bistatic radar with the synthetic aperture of the transmitter.

The indeterminacy function is a universal characteristic of the signal, which shows its impact on the main qualitative indices of the system. Particularly, the width of the major lobe maximum and the minor lobe level of the module of generalized indeterminacy function of the signal are indicative of selective properties of the system. The accuracy of parameter estimation at a given signal-to-noise ratio depends on sharpness of the main maximum of the indeterminacy function.

The complex generalized indeterminacy function of a time signal is defined by expression [1]

$$\Psi(l_1, l_2) = \int s(t; l_1) s^*(t; l_2) dt$$

(1)
REFERENCES


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