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THE *J*-CORRELATION METHOD OF DIRECTION FINDING DURING PSEUDONOISE SIGNAL PROCESSING

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Two implementations of the *J*-correlation method of direction finding for pseudonoise signal processing are considered. Expressions describing the bearing characteristics are derived, and the condition, corresponding to direction finder's nonperiodic characteristic, is formulated. It is shown that the steepness of the bearing characteristic in the *J*-th correlation method of direction finding increases when the spectrum of the received signal becomes more complicated.

The *J*-correlation method (JCM) of direction finding was suggested in [1], and analysis of its two versions — JCM-1 and JCM-2 — was performed in [2, 3]. These works define bearing characteristics of the method and steepness of these characteristics when the received signal is modulated in frequency by a harmonic oscillation. However, it would be interesting to know the behavior of JCM bearing characteristics if we receive a signal modulated in frequency by some complex voltage. The purpose of this work is analysis of the *J*-correlation method of direction finding when receiving a pseudonoise signal.

The block diagram of the device realizing the JCM method of direction finding is shown in Fig. 1, where: An1 and An2 are antennas, CDL — a calibrated controlled delay line; FDL — fixed delay line; MIX — mixer; G — high-stable quartz generator; X1, X2, and X3 — multipliers; BRF1 and BRF2 — band-rejection filters; NBF — narrow-band filter; LA — logarithmic amplifier; and AD — amplitude detector.

A pseudonoise signal can be represented as

$$U_s(t) = U_s \cos\left[Wt + \sum_{k=1}^{N} \beta_k \sin\left(\Omega_k t + \varphi_k\right)\right]$$

where U_s is the signal amplitude; W is the signal carrier frequency; N — the number of harmonic components of the modulating voltage; β_k — the modulation index of the harmonic oscillation with frequency Ω_k; and φ_k — the initial phase of the kth harmonic component of the signal.

The signal $U_s(t)$, after passing two propagation channels, at the device inputs can be written as

$$U(t) = U\cos\left[Wt + \sum_{k=1}^{N} \beta_k \sin\left(\Omega_k t + \varphi_k\right)\right];$$

$$U(t+\tau) = U\cos\left[W\left(t+\tau\right) + \sum_{k=1}^{N} \beta_k \sin\left[\Omega_k\left(t+\tau\right) + \varphi_k\right]\right],$$

where U is the signal amplitude, and τ is the spatial time delay of the input signals.

Upon processing of the voltages $U_s(t)$ and $U_s(t+\tau)$ in the reference (CDL, MIX, G, DL, and X1) and in the controlled (CDL, FDL, MIX, G, DL, and X2) channels, their output signals can be written in the form

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