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A METHOD FOR DECREASING SIDE LOBE LEVELS AT COMPRESSION OF PHASE-KEYED SIGNALS IN RADIO-ENGINEERING AIDS

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The paper considers a method for lowering side lobes' level of phase-keyed signals at the output of a compression filter in radio-engineering facilities. The loss of SNR arising from mismatched reception of phase-keyed signals is estimated.

Statement of the problem. Usually, in the theory of detection and resolution of signals, two cases of detection-resolution are the object of special attention [1]: detection and resolution of closely spaced signals; and detection and resolution of signals from one target against the interference background created by a signal from some other target.

The first case corresponds to a situation dealing with detection and measurement of parameters of the targets whose ranges or velocities are close to each other (the signal intensities are assumed commensurable if not equal). The second case refers to detecting complex signals, when the parameters of the targets are assumed to differ considerably, and signal's intensities may differ as well.

In the first case, in order to resolve the problem of detection-resolution, the following condition has to be met [2]:

$$q_{\text{s}} \cdot |\psi(0,0)|^2 \cdot \left\lfloor 1 - |\psi(\tau, F)|^2 \right\rfloor \geq q_{\text{thr}}, \tag{1}$$

where $q_s = p_s/p_n$ is signal-to-noise ratio for the signals to be detected and resolved; q_{thr} is the signal-to-noise ratio corresponding to the required quality of signal detection (threshold signal-to-noise ratio); $\psi(\tau, F)$ is the normalized two-dimensional autocorrelation function of the signal (at matched reception) or the function of cross-correlation between the signal and the filter pulse response (at mismatched reception); while τ and F denote the time and frequency shifts of the signals.

The factors responsible for fulfillment of condition (1) are intensity of the signal and the width of the two-dimensional autocorrelation function (ACF) $\psi_{\text{ac}}(\tau, F)$ or the cross-correlation function (CCF) $\psi_{\text{cc}}(\tau, F)$. In the general case, the following relations are true $|\psi_{\text{ac}}(\tau, F)| \leq 1$, and $|\psi_{\text{cc}}(\tau, F)| < 1$.

In the second case, for successful treatment of the detection-resolution problem, the "weaker" signal (the first one, for instance) has to meet the condition

$$q_{\text{s2}} \cdot \left|\psi(\tau, F)\right|^2 < q_{\text{thr}} \leq q_{\text{s1}} \cdot \left|\psi(0,0)\right|^2. \tag{2}$$

As can be seen, in the second case the governing factor for appropriate treatment of the detection-resolution problem, when the "weak" signal intensity is sufficient for detecting it against the background of intrinsic noise of the reception channel of the radio-engineering system (RES), is the level of spurious maximums of the functions $\psi_{\text{ac}}(\tau, F)$ or $\psi_{\text{cc}}(\tau, F)$. It means that the quality of detection-resolution for PK-signals of qifferent strength can be improved only at the expense of lowering the side lobe levels of ACF or CCF mentioned above.

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