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# ADAPTIVE THRESHOLD DEVICES

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**The paper considers algorithms of adaptation of threshold level of signal detection and the relevant devices, which, under the conditions of a priory indeterminacy of interference characteristics, make it possible to avoid loss in the threshold signal without exceeding the prescribed false alarm level.**

When detecting radar signals against the background of interference composed of intrinsic noise and some external impacts, the level of interference residue at the input of the threshold device of signal detection is a priori unknown and depends on a number of factors: intensity and spectral-correlation characteristics of the external interference (passive in particular), sensitivity and gain factor of the radar receiver and adaptively readjustable structure and parameters of the signal processing system. In the systems of automatic processing of radar information, this situation leads us to the problem of keeping the average number of false targets at a level not exceeding some prescribed value. Otherwise we deal with memory overload, the time necessary for extracting the useful information from the secondary (trajectory) processing computer grows, and the number of false trajectories increases as well. On the other hand, keeping the false alarm repetition rate at a level below the prescribed one may lead to a loss of signals from actual targets. The value of false alarm probability (repetition rate) can be held at a prescribed level by adaptation of the threshold level of detection.

Solution of the problem thus formulated can be obtained by some methods of optimization of the systems responsible for processing of signals against the interference background. One of these methods consists in repeatedly changing the relevant system parameters based on estimating the gradient of the system index to be fixed [1]. The method cannot be called parametric, since it does not require estimation of the interference parameters and, hence, can be realized easily. True enough, the rate of convergence of the corresponding adaptation algorithm is rather low: because of low repetition rate of false alarms, estimation of its gradient demands for a large number of realizations. We can eliminate this drawback if using the methods of direct estimation of interference parameters sought for.

When estimating the interference parameters at the processing system input, adaptation of threshold level can be implemented only for non-adaptive processing systems — with the aid of calculated in advance and introduced (in the system) dependencies of the threshold level on interference characteristics for the processing system under consideration. A simpler and more versatile way, suitable for a broad class of processing systems, is adaptation of threshold level by estimating the parameters of interference residue at the processing system output. In this case we use the functional relation between the threshold level and the parameters characterizing the law of distribution of interference residues at the threshold device input. The sought law of distribution of interference residues depends on the type of the algorithm responsible for processing of input data.

In the systems of coherent processing of signals against passive interference background, where we perform coherent rejection and/or multichannel Doppler's filtration [2], we have to calculate the values $u_i = |U_i|^2$, where $U_i$ is the output value of the $i$th Doppler's channel of the processing system. For Gaussian distribution of the processed data the distribution of the decision statistic $u = u_i$ is exponential:

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