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ESTIMATION OF SIGNAL PARAMETERS AT TWO-STAGE PROCESSING

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The paper considers the problem of estimating the vector of signal parameters in a large a priori domain in the presence of fluctuation noise and Bernoulli's flow of pulses. It is suggested to include, in the algorithm of processing of received signals, a median filter to weaken the pulse flow. The correlation matrix of estimation of the unknown vectorial parameter of signal and the probability of reliable estimation of this parameter are found, with the results of statistical simulation included.

The digital communication systems incorporate a number of subsystems to perform such procedures as waiting for a call, establishment of communication with some or other subscriber and entering into synchronism, reception of data messages, and a whole number of other principal and auxiliary operations. The environmental conditions of the present-day radio-engineering facilities are such that in the receiver, in addition to fluctuation noise $\eta(t)$ and the legitimate signal $s(t, \lambda_0)$, a pulse flow $\chi(t)$ of regular or chaotic structure may exist. The totality of Gaussian noise and of the flow of quasideterminate pulses will be called the combined interference. The design of reception systems, immune to pulse interference, is considered in a large number of works [1, 2, etc.]. In [3] we suggested a two-stage algorithm for treatment of an observed process $s(t, \lambda_0) + \chi(t) + \eta(t)$. The first stage corresponds to the median filtering, which permits, with high probability, to exclude pulses from the flow $\chi(t)$. After that we can perform processing of the filtered process by a device designed only for the fluctuation component. The cited work contains also an approach to calculation of characteristics of detection of a signal with unknown parameters against the combined interference background. The present work considers the problem of estimation of the vector-like information parameter λ of a signal, observed against the combined interference background, with the aid of two-stage processing.

Assume that at the receiver input, within the interval $[0, T]$, we observe a mixture of fluctuation noise $\eta(t)$, legitimate signal $s(t, \lambda_0)$, and pulse flow $\chi(t)$:

$$X(t) = s(t, \lambda_0) + \chi(t) + \eta(t). \qquad (1)$$

The information parameter $\lambda = (\lambda^{(1)}, \ldots, \lambda^{(\mu)})$ represents a μ-dimensional vector belonging to a priori domain Ω, which contains many elements of resolution for this parameter. Moreover, one of the components is the unknown time position of the signal. Assume that the noise $\eta(t)$ is a Gaussian process with the zero mean and the correlation function $K_\eta(\tau)$. The flow of pulses $\chi(t)$ has the form

$$\chi(t) = \sum_{k=1}^{n} \varepsilon_k a_k f_k(t - \tau_k)$$

where a_k is the amplitude of a pulse in the flow; τ_k is its unknown time position; the multiplier $\varepsilon_k = 1$with the probability p_k, and $\varepsilon_k = 0$ with the probability $1 - p_k$.

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