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FILTRATION OF ESTIMATES OF SIGNAL'S INFORMATION PARAMETERS WITH RESOLVING THEIR CLASSES

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The paper is devoted to application of a Kalman's filter to estimating the parameters of distributions describing the classes of signals. The primary estimates of distribution parameters are obtained by the iterative method of maximum likelihood. The Kalman filter has been simulated such that direct measurements give for this filter acceptable estimates of mean values and variances of errors in the delay time and the carrier frequency. The estimations are performed for a single class of stochastic signals.

In [1, 2] we considered the resolution of signal classes with the aid of the iterative method of maximum likelihood. According to [2], by a class of signals is meant a totality of signals from a source, when essential parameters of the signals are changing from signal to signal in a random manner. The resolution of signals consists in estimating parameters of partial distributions characterizing the classes, and in relating signals to their classes. In this case the procedure of resolution of signal classes is preceded by resolution of signals.

The essence of the iterative method of maximum likelihood is as follows. On order to find the maximum value of the likelihood function, we use an iterative procedure rather than treatment of the equation system. At the $(t + 1)$th step the parameters to be estimated are selected so that the logarithm of the likelihood function is larger than its magnitude at the step t. The advantage of this method is that the obtained estimates always correspond to a maximum of the likelihood function rather than to points of inflection, or minimums and maximums, inherent in the roots of the likelihood equations.

The estimates of parameters of partial probability densities, obtained by the iterative method of maximum likelihood, are asymptotically effective. But they are estimates in a point, i.e., at a fixed time moment. Of interest is the issue of dynamic estimation, i.e., with regard for motion of a subscriber of the information system. This "tracking" measurement can be performed with the aid of Kalman's filter. The use of such filter is possible if the sequence of estimates is Gaussian-Markovian type. We adopt this model, suitable for practical situations, investigate the estimates of mean values and of the correlation matrix of errors in estimating the classes of signals, when these classes have been obtained by the maximum likelihood method.

In the case of direct measurement the state equation can be written in the form

$$\vec{a}_{k+1} = \vec{B}_k \vec{a}_k + \vec{\mu}_k$$

where $\vec{a}_k$ and $\vec{a}_{k+1}$ are the mean values of vectors for the kth and $(k + 1)$th steps, respectively; $\vec{\mu}_k$ is a random many-dimensional quantity distributed by the Gaussian law with the zero mean; $\vec{B}_k$ is the $m \times m$ matrix of linear transformation; and m is the signal dimensionality.

The vector $\vec{\mu}_k$ permits to account random variations of some parameter of the signal $\vec{a}_{k+1}$, for example, at target's maneuvering. The components of the random vector $\vec{\mu}_k$ are not interrelated in the general case. They are formed by independent random number generators with unit variance, whose output voltages comprise the vector $\vec{\mu}_{ok}$. The vector

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