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THE USE OF WHITENING FILTERS FOR CLUTTER SUPPRESSION IN MOBILE RADIO-COMMUNICATION SYSTEMS

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A new model was suggested to describe the interference situation in mobile radio-communication systems. The model was used in the synthesis of an adaptive algorithm of signal reception with the suppression of different types of clutter by means of digital whitening filtration. The results of modeling of a digital whitening filter were presented.

Three types of interference have a substantial impact on the signal reception quality in mobile radio-communication systems: (1) those concentrated in spectrum (narrow-band or selective interference), (2) concentrated in time (pulse or discontinuous jamming), and (3) concentrated in space (pattern-like). There is a whole number of systems and methods to suppress each type of clutter mentioned above separately, but we do not know any universal theory piecing these methods into a single system. One of ways to protecting the radio-communication systems from clutter is the use of digital adaptive algorithms of reception with compensation of the interference. Analysis of results obtained in [1, 2] shows that the most serious problems emerge when realizing the algorithms of signal reception in the presence of interference with a priori unknown parameters. Of interest is the investigation of possibilities for realization of adaptive algorithms of signal reception with the use of digital whitening filters for clutter suppression.

Let an $M \times K$-element antenna system yield an $M \times K$-dimensional signal, whose realizations at the output of every element of the antenna system are, in the general case, correlated to each other. This signal can be written as a many-dimensional complex vector

$$\dot{X}(t) = \begin{pmatrix} \dot{x}_{11}(t) \ldots \dot{x}_{1K}(t) \\ \dot{x}_{21}(t) \ldots \dot{x}_{2K}(t) \\ \ldots \\ \dot{x}_{M1}(t) \ldots \dot{x}_{MK}(t) \end{pmatrix}. \quad (1)$$

The received signal (1) can also be represented by an expression

$$\dot{X}(t) = \dot{A} \cdot \dot{U}_r(t, \alpha_r) + \dot{n}(t, \nu), \; (r = 1, 2, \ldots, R), \quad (2)$$

where $\dot{U}_r(t)$ is the rth variant of the legitimate signal transmitted; and $\dot{A}$ is a many-dimensional matrix describing the transmission channel.

The totality of interference elements is described by a many-dimensional matrix $\dot{n}(t, \nu)$ of their sampled values. The interference parameters ν are determined from the learning sample of the signal received. Assume that the totality of interference elements has the normal-law distribution. In the general case, the clutter is nonstationary. Different sampling elements n_m and n_k may depend on each other, so that their centered correlation moment may be nonzero. The rate of

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