

СЕКЦІЯ 5

СУЧАСНІ ІНФОРМАЦІЙНО-ВИМІРЮВАЛЬНІ СИСТЕМИ

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RESEARCH AND MATHEMATICAL DESCRIPTION OF DIFFERENT SOURCES OF INTERFERENCE

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At present, the transmission messages via various types of communication channels requires studying and researching the descriptions various sources of interference in order to increase the noise immunity of digital signal reception. In this regard, let us move on to the issue of the mathematical description various sources of interference. It follows that interference can be represented as a random function of time. A random function of discrete time is usually called a random sequence, a random function continuous time is called a random process. Random functions are characterized by their distributions. Numerical characteristics in the form of distribution moments are also used.

The following inequalities are characteristic for impulse interference:

$$\tau_i \ll T_i, \quad T_i \gg \tau_y, \quad \tau_i < \tau_c,$$

where τ_y - the establishment time of the circuit affected by the impulse interference; τ_c - duration of an elementary signal transmission; T_i - the interval of following.

Pulse interference is created mainly by industrial and atmospheric sources. The analytical record of the implementation of a random pulse process has the form:

$$u_n(t) = \sum_{i=1}^n U_{mi} \varphi(t - t_i, \tau_i), \quad (1)$$

where t_i - is the time of occurrence of the i -th pulse; τ_i - is its duration; where t_i is the time occurrence of the i -th pulse; τ_i is its duration; U_{mi} – максимальное значение напряжения для i -го импульса. Spectral density of the pulse noise amplitudes according to the Fourier transform:

$$S(j\omega) = \int_0^{\infty} u_n(t) e^{j\omega t} dt = \int_0^{\infty} U_{nm} e^{\alpha t} e^{-j\omega t} dt, \quad (2)$$

where $S(j\omega) = U_{nm} / \sqrt{\alpha^2 + \omega^2}$.

Impulse interference is characterized by a broadband spectrum that decreases with frequency. From (1) and (2) it is clear that impulse interference is characterized by a broadband spectrum that decreases with frequency.

The shorter the duration of the interference, i.e. the greater the coefficient α , the wider and more uniform the spectrum in frequency. The spectrum width of the pulsed interference is usually greater than the spectrum width of the signal. The distribution of amplitudes - in particular, for atmospheric interference is satisfactorily described by the logarithmic Gaussian law

$$W(U_{nm}) = \frac{1}{\sqrt{2\pi}\sigma_n} \exp\left[-\left(\frac{\lg^2 U_{nm}}{2\sigma_n^2}\right)\right], \quad \sigma_n^2 = \overline{\lg^2 U_{nm}}, \quad (3)$$

The distribution of pulses in time is close to the Poisson distribution:

$$F(k, \theta) = \left[\frac{\theta / T_{cp}}{k!} \right] e^{-\theta / T_{cp}}, \quad (4)$$

where $F(k, \theta)$ – is the probability of the occurrence k pulses during time θ ; T_{cp} – is the average repetition period of the pulse interference.

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