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CALCULATION OF PARAMETERS OF ERRORS IN RADIOELECTRONIC AND TELECOMMUNICATION SYSTEMS

Анотація. Об’єктом даного дослідження є аналітичний розрахунок параметрів помилок в радіоелектронних та телекомунікаційних системах.
Ключові слова: обробка сигналів, критерій ефективності, математичне сподівання, параметри помилок.

Abstract. The object of this study is analytical calculation of error parameters in radio electronic and telecommunication systems.
Keywords: signal processing, criterion of efficiency, mathematical expectation, Error parameters.

The analysis of the signal identification error is a criterion for the efficiency of the receiver. The literature deals with error estimates [1-3], as well as numerical and experimental methods for their determination [2]. In the majority of cases, they are used to locate and identify radar signals, which is characterized by a certain specificity of the system construction and involves the use of the Neumann-Pearson criterion. That is, the main task of the work is to identify and calculate the error parameters of the accepted code combination, which provides certain signs of the link.

In the paper [1] various modes and conditions of data transmission are considered, among which the main variants can are distinguished:

- the signal with the given signs of reference is subject to the Relay Law. Noise has Gaussian character, where the reference can are defined in this way [2]

$$P_0 = P_n^{\frac{1}{1+\sqrt{\frac{E_S}{2G_0}}}} = P_n^{\frac{1}{1+\sqrt{\frac{\delta}{4}}}} = P_n^{\frac{1}{1+\sqrt{\frac{h^2}{4}}}}; \qquad (1)$$

- the channel has a fully Gaussian character, both for the informative signal and for the noise, where the reference can are defined in this way

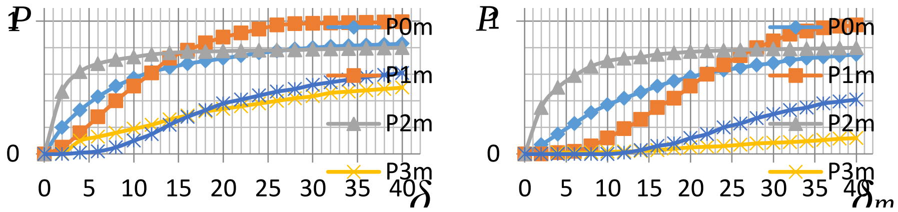
$$P_0 = 0,5 + \frac{1}{\pi}\int_0^\infty \frac{\mathrm{Im}\left(q_1(x)e^{-ixz_n}\right)}{x}dx, \qquad (2)$$

where $q_1(x)$ is the characteristic function of the hypothesis of the presence of a reference sign; z_n is the threshold value of z, which depends P_n:

$$P_n = 0,5 + \frac{1}{\pi}\int_0^\infty \frac{\mathrm{Im}\left(q_0(x)e^{-ixz_n}\right)}{x}dx. \qquad (3)$$

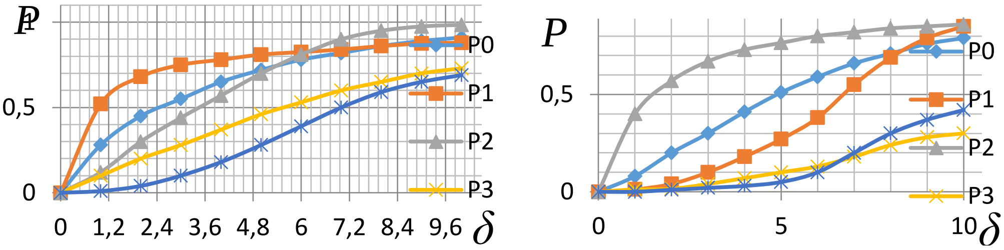
where $q_0(x)$ is the characteristic function for the hypothesis of the absence of a link sign.

The calculations are carried out for the probabilities of the absence of the sign of reference, P_n=10^{-3} and P_n=10^{-5}. The results are shown in Fig. 1-2.



a) *b*)

Fig. 1 – Approximation of probabilities are calculated by different methods to the value of P_0 under the Relay information signal and $P_n = 10^{-3}$(*a*), $P_n = 10^{-5}$ (*b*)



a) *b*)

Fig. 2 – Approximation of probabilities are calculated by different methods to the value of P_0 for the Gaussian channel and $P_n = 10^{-3}$(*a*), $P_n = 10^{-5}$ (*b*)

It is expedient to analyze the errors with the value $\eta = h^2$, at which the probability approaches the critical value of 0,5. The solid line in the fig. is a graph of the exact values of P_0, calculated by the formulas respectively (1) and (2).

The analysis of the graphs shows that the indicator P_1 differs from the values of P_0 by not more than by 12% in the first and by no more than by 24% in the second case, and it reaches the exact value at h^2 = 12 ... 24 depending on the given error P_n in the first case and at h^2 = 8 ... 10 depending on the given error P_n – in the second.

References

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