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Optimization of process of exchange information in the computer systems

Basic parameters which influence on the transmission process and which can be varied is:

- power of signal of transmitter $P_{c.nep}$, to regulate which simpler all;
- speed of transmission υ, the change of which though needs certain charges, but special technical complexities does not cause;
- length of code combination n_{kod} which is determined the chosen method of code and amount of errors which are determined and corrected. The change of this parameter requires the change of algorithm of previous preparation of information;
- a coefficient k_υ, the value of which is characterized principle of construction of signal of transmitter (by a presence and duration of pauses between informing signals). The correction of this parameter requires the change of forming algorithm of signal a software-based, hardware-based or combined way [1 – 3].

The transmission of information by the communication channel it is possible not only separate bytes but also blocks, long N_b bytes. Then, the index of quality of information transmission depends a communication by channel E_k on composition of signal vector $\bar{x}_n$ which is transmitted, probability of distortion of the elementary signal p_0, block length which is transmitted, N_b and amount of errors which are corrected, t. Thus, the task of construction of code can be formulated in a kind:

$$\begin{cases} E_k = \max\limits_{\bar{x}_n, p_0, N_b, t} E_k(\bar{x}_n, p_0, N_b, t) \\ \upsilon_k \to \upsilon_{nop} \\ p_k \to p_{nop} \end{cases}, \quad (1)$$

where $\upsilon_k = N_b / T = (8k_\upsilon \cdot N_b) / \tau$ – transmission speed of the information;

p_k – probability of correct acceptance of block N_b data bytes;

p_{nop} – threshold probability of correct acceptance of block N_b data bytes;

υ_k – speed of information transmission by a communication channel;

υ_{nop} – threshold speed of information transmission by a communication channel;

T – time of transmission the block N_b data bytes,

taking into account the maximum value of volume of signal V_k £ V_{nop} .

For the second case index of quality of the information transmission by a communication channel E_k depends on composition of the signal vector $\bar{x}_n$ which is transmitted, probability of distortion of the elementary signal p_0, size of block which is transmitted, N_b and amount of repetitions r. Thus, the task of construction of code can be formulated in a kind

$$\begin{cases} E_k = \max\limits_{\bar{x}_n, p_0, N_b, r} E_k(\bar{x}_n, p_0, N_b, r) \\ v_k \to v_{nop} \\ p_k \to p_{nop} \end{cases}, \qquad (2)$$

thus in both cases threshold speed of information transmission is determined after the Shannon methodic [4].

Mathematical models which bind probability of authentication of informing signal to ratio *signal/noise*, and mathematical models which allow to define the maximal value of effective speed of transmission for the real terms, method and code parameters are got [5 – 8]. It characterizes local optimums of objective function which describes the process of information transmission. If as an index of quality of the information transmission by a channel E_k take the volume of signal, its minimization on condition of providing of necessary veracity of exchange information fully answers both a purpose and conducted researches. Coming from it, objective function (1) and (2) it is possible to give in a kind:

$$\begin{cases} V_c \to \min \\ p(\hat{X}_c) \le p_{äð}(X_c) \\ F = const \\ P_{c.ïåð} \le Ð_{ïåð.äð} \\ \upsilon \le \upsilon_{äð} = \dfrac{1}{t_{ïáð}} \end{cases}. \qquad (3)$$

The condition $F = const$ shows that the bar of frequencies for forming of communication channel is determined normatively and can not change, and power of signal of transmitter $P_{c.nep}$ can not exceed a maximum value for providing of capacity of the system on the whole. Speed of information transmission υ also must not exceed a maximum value which is determined by the cycle of manipulation of information on a receiver.

At the use of methods (n, k)-coding volume of signal V_c is possible to define as

$$V_c = F \cdot T \cdot \log\left(\frac{P_c}{G_\xi}\right) = F \cdot \left((n+k)\cdot t_0\right) \cdot \log\left(\frac{P_c}{G_\xi}\right) = F \cdot \frac{n+k}{\upsilon} \cdot \log\left(\frac{P_c}{G_\xi}\right). \quad (4)$$

Minimization of form (4) at implementation of the formulated limitations allows to define the optimum mode of exchange information at the real terms of connection. Passing to the logarithmic axes of coordinates,

$$\log V_c = \log F + \log(n+k) - \log \upsilon + \log\left(\log P_c - \log G_\xi\right), \quad (5)$$

task of search of a minimum of volume of signal V_c can be erected to the task of the linear programming, which simply enough gets untied by a simplex method [9].

Like the volume of signal can be defined and for the terms of the majority decoding

$$V_c = F \cdot T \cdot \log\left(\frac{P_c}{G_\xi}\right) = F \cdot \left(r \cdot t_0\right) \cdot \log\left(\frac{P_c}{G_\xi}\right) = F \cdot \frac{r}{\upsilon} \cdot \log\left(\frac{P_c}{G_\xi}\right). \quad (6)$$

And in this case the task of optimization can be erected to the decision the task of the linear programming by a simplex method

$$\log V_c = \log F + \log r - \log \upsilon + \log\left(\log P_c - \log G_\xi\right). \quad (7)$$

Thus, higher ratio and algorithms of adaptation is got fully acceptable to achievement of optimum terms of information transmission and realization both parametric and structural- algorithmic optimizations.

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