УДК 621.391

KRASNOBAYEV V. A., Doctor of Technical Sciences,
MAVRINA M. A., graduate student (Poltava National Technical Yuri Kondratyuk University)

Method of operative diagnostic data errors by the computing devices of the processing data in a communication node telecommunications network that are functioning in residue number system

Presented Doctor of Technical Sciences Prihodko S.I.

In this paper propose the method of diagnostic data errors in computer devices that are functioning in residue number system. This method allows to raise the efficiency of the diagnostic data errors in modern telecommunication networks.

Key words: *residue class, communication node, telecommunication network, computer devices of the processing data, operative data diagnostic.*

1. Introduction

The bases of the modern means for processing information of a communication node (CN) telecommunications network (TN) are computer devices of the processing data (CDPD).

The problem of achieving high efficiency of the telecommunications system as a whole is improved, especially such characteristics CDPD CN TN as the veracity, performance and reliability of the processing data.

From the literature [1-3] it is known that the use of non-positional number system of residue classes (RC) can provide high performance custom implementation of numerical algorithms, consisting of a set of arithmetic operations. However, the need to ensure a reliable and fail-safe operation of the CDPD the development and implementation of new operational methods for effective monitoring and diagnostics data errors in RC, other than the methods used in conventional binary positional number systems (PNS) [4].

The aim of the research outlined in this article, is to increase the efficiency of the process diagnostic of data errors in the CDPD operating in RC.

Thus, important and relevant researches for the development and improvement of method the rapid diagnostics of data errors in the CDPD operating in RC.

2. Main part

In general, the process of correction (detection and reclaim) errors in the code information structure of the data $\tilde{A}$ presented in RC consists of the following major steps:

– control data (process discovery of the existence errors in the non-positional code structure $\tilde{A} = (a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n)$ RC);

– diagnostics data (localization the place of errors with a given depth of diagnostics);

– reclaim errors in the code data structure (recovery distorted residues $\tilde{a}_j \left(j = \overline{1, n}\right)$ of the wrong number $\tilde{A}$ and obtain the correct number A).

The number $A = (a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n)$ in non-redundant RC is represented by the set $\{a_i\} \left(i = \overline{1, n}\right)$ of residues $a_i \equiv A(\bmod m_i)$ for the system information bases (modules) $\{m_i\}$ in the numerical information interval $[0, M)$ (where $M = \prod_{i=1}^{n} m_i$ – the total number of information code words). Herewith the greatest common divisor (GCD) $(m_i, m_j) = 1;\ i, j = \overline{1, n}\ (i \neq j)$.

In order to the fail-code RC has the necessary corrective abilities required to contain certain information redundancy. In this case, first, it is necessary to define (identify) and, if possible, quantify the pre-existing (natural) in the source code structure information redundancy. Secondly, with the task of providing additional data correction capabilities, introduce an additional (artificial) information redundancy (apply the method of information redundancy) by introducing additional (control) bases $\{m_k\}$ RC.

For solving the problem of ensuring the data in the RC additional correction capabilities, we assume that to n information bases added one additional $m_k = m_{n+1}$ control base is relatively prime to any of the existing information bases. In this case number $A = (a_1 \| a_2 \| ... \| a_n \| a_{n+1})$ in RC is represented by the set $\{m_j\} (j = \overline{1, n+1})$ bases in full (working) numeric $[0, M_0)$ interval, where $M_0 = M \cdot m_{n+1}$ – the total number of code words for a given RC.

It is known [1] that for non-positional coding structures in RC minimum code distance defined by the expression $d_{\min} = k + 1$, it depends on the number k of control base and the amount of each of them. If the condition $\prod_{i=1}^{r} m_{z_i} \le m_k$ for control bases m_{z_i} is met, then the introduction in the system of bases RC one control $m_k = m_{n+1}$ base is equivalent to having r control bases $m_{z_1}, m_{z_2}, ..., m_{z_r}$. Given the fact that all the numbers taking part in the processing of data in the CDPD (transmission and processing of information), as well as the result of the operation is in information numerical interval $[0, M)$, it is obvious that if the result of the data obtained by the final result that $A \ge M$, it means that the obtained number $\tilde{A}$ distorted (by incorrect). Thus, if $A < M$, it is concluded that the number A is correct, and if $A \ge M$, the number $\tilde{A}$ is wrong. Are assumed to be only single (only one of the residues $\{a_i\}$ of A) error or packet errors of length less than $l = [\log_2 (m_i - 1)] + 1$ bits within one residue by modulo m_i. Note that the principle of comparing the value A with a value information numerical interval $[0, M)$ is base all existing methods of monitoring data in RC [3-5]. The essence of diagnosis non-positional code structure (NCS) in RC $A = (a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n \| a_{n+1})$ consists in revealing of distorted residues $m_{z_i} (i = \overline{1, r})$.

Consider the list of scientific assertions, the results of the evidence which can form the basis of the method of diagnostic errors data presented in non-positional residue number system [1, 4, 5].

Recall that in the future will provide only single error (in one residue $a_i (i = \overline{1, n+1})$, number $A = (a_1 \| a_2 \| ... \| a_n \| a_{n+1})$, presented in RC).

Assertion 1. Let an ordered system of bases in RC $m_i < m_{i+1}, i = \overline{1, n}$ with n information and one $m_k = m_{n+1}$ control bases, and let the number $A = (a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n \| a_{n+1})$ undistorted (right), $A < \mathrm{M}_0 / m_{n+1}$, where $M_0 = M \cdot m_{n+1}$ and $M = \prod_{i=1}^{n} m_i$. The value A does not change if the number will be represented in RC from which it is withdrawn one base m_i, i.e. if in the representation of A to remove the residue a_i. Thus obtained number $A_i = (a_1 \| a_2 \| ... \| a_{i-1} \| a_{i+1} \| ... \| a_n \| a_{n+1})$ is called the projection of the number of A by modulo m_i.

Assertion 2. If in the ordered system bases of RC set the correct number A, then the projections $A_i (i = \overline{1, n+1})$ of this number equal to each other, $A = A_1 = A_2 = ... = A_i = ... = A_n = A_{n+1} < \mathrm{M}_0 / m_{n+1}$.

Indeed, for the correct number A has relation holds $A < \mathrm{M}_0 / m_{n+1} < \mathrm{M}_0 / m_k < ... < \mathrm{M}_0 / m_i < ... < \mathrm{M}_0 / m_1$. Then, in accordance with the results of assertion 1, we have that $A = A_i$.

Assertion 3. Suppose that for an ordered system bases of RC all possible projections $A_i = (a_1 \| a_2 \| ... \| a_{i-1} \| a_{i+1} \| ... \| a_n \| a_{n+1})$ $A_i (i = \overline{1, n+1})$ number $A = (a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n \| a_{n+1})$ coincide. In this case the number $A = (a_1 \| a_2 \| ... \| a_n \| a_{n+1})$ is correct.

Show it. Assume that the number $A = (a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n \| a_{n+1})$ is incorrect due to distortion residue a_i by modulo m_i. Replace in number A distorted residue a_i on the right $\tilde{a}_i$. In this case, received the correct number $\tilde{A} = (a_1 \| a_2 \| ... \| \tilde{a}_i \| ... \| a_n \| a_{n+1})$. Then, in accordance with the result of assertion 3, we have $\tilde{A}_1 = \tilde{A}_2 = ... = \tilde{A}_i = ... = \tilde{A}_n = \tilde{A}_{n+1}$.

However, $A_i = \left(a_1 \| a_2 \| ... \| a_{i-1} \| a_{i+1} \| ... \| a_n \| a_{n+1}\right)$ and $\tilde{A}_i = \left(a_1 \| a_2 \| ... \| a_{i-1} \| a_{i+1} \| ... \| a_n \| a_{n+1}\right)$ concurrently, i.e. $A_i = \tilde{A}_i$. In this case the following relation must be performed

$A = A_1 = \tilde{A}_1 = A_2 = \tilde{A}_2 = ... = A_n = \tilde{A}_n = A_{n+1} = \tilde{A}_{n+1}$.

However, by the condition of assertion 2 projection $A_j\left(i \neq j\right)$ of the number A differs from projection A_i by the value of the residue a_i by the base m_i. Because of this $A_i \neq A_j$, this contradicts the hypothesis that number A is wrong.

Assertion 4. If in the ordered system of bases RC projection $A_i = \left(a_1 \| a_2 \| ... \| a_{i-1} \| a_{i+1} \| ... \| a_n \| a_{n+1}\right)$ number $A = \left(a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n \| a_{n+1}\right)$ satisfies the condition $A_i \geq \mathrm{M}_0 / m_{n+1}$, then this case is considered that the residue a_i of number A by modulo m_i authentically not distorted. Note again that will provide for single mistake.

Indeed, if residue a_i of number A by modulo m_i distorted, then the projection of A_i consisting of the undistorted $a_j\left(j = \overline{1, n+1}\right)$ and $i \neq j$ residues must be a wright number. However, by condition $A_i \geq \mathrm{M}_0 / m_{n+1}$ – a wrong number, which contradicts the assertion 2. In addition, we note that if all the values $A_i \geq \mathrm{M}_0 / m_{n+1}$ $\left(i = \overline{1, n}\right)$ then distorted residue a_{n+1}.

On the basis of the above scientific assertions, consider the method of diagnostics data presented in RC.

Suppose given a number to be tested $A = \left(a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n \| a_{n+1}\right)$ in RC with n information $m_i \, (i = \overline{1, n})$ and one control $m_k = m_{n+1}$ bases.

It is necessary, firstly, to inspect (to determine the correctness) of number A, and, secondly, to make a diagnosis residues $a_i\left(i = \overline{1, n+1}\right)$ of number A, i.e. identify distorted (or undistorted) residues.

On the basis of evidence on the 3 and 4 assertions developed a method of diagnostic data presented in RC, which is shown on fig. 1.

1	**Definition the private M_i working bases RC** $M_1 = m_2 \cdot m_3 ... m_{i-1} \cdot m_i \cdot m_{i+1} ... m_n \cdot m_{n+1}$, $M_2 = m_1 \cdot m_3 ... m_{i-1} \cdot m_i \cdot m_{i+1} ... m_n \cdot m_{n+1}$, . . . $M_i = m_1 \cdot m_2 ... m_{i-1} \cdot m_{i+1} ... m_n \cdot m_{n+1}$, . . . $M_n = m_1 \cdot m_2 ... m_{i-1} \cdot m_i \cdot m_{i+1} ... m_{n-1} \cdot m_{n+1}$, $M_{n+1} = M = M_0 / m_{n+1} = m_1 \cdot m_2 ... m_{i-1} \cdot m_i \cdot m_{i+1} ... m_{n-1} \cdot m_n$.
2	**Definition the private $B_{ij} = M_i \cdot \overline{m}_{ij} / m_i = 1 (\mathrm{mod}\, m_i)$ orthogonal bases for this RC** $M = \prod_{i=1}^{n} m_i$, $M_0 = \prod_{i=1}^{n+1} m_i = M \cdot m_{n+1}$, $M_i = \prod_{k=1, k \neq i}^{n+1} m_k$ $\overline{m}_{ij} = \overline{1, m_i - 1}$, $j = \overline{1, n+1}$ – number of bases by initial RC; $i = \overline{1, n}$ – number of bases RC in set of private working bases RC $\left(j = i+1\right)$ B_{11} B_{21} B_{31} $\cdots$ $B_{(n-1)1}$ B_{n1} B_{12} B_{22} B_{32} $\cdots$ $B_{(n-1)2}$ B_{n2} $\cdots$ $B_{1(n+1)}$ $B_{2(n+1)}$ $B_{3(n+1)}$ $\cdots$ $B_{(n-1)(n+1)}$ $B_{n(n+1)}$

3	**Definition the projections $\widetilde{A}_j$ number $\widetilde{A}=\left(a_1\|a_2\|\ldots\|a_i\|\ldots\|a_n\|a_{n+1}\right)$**
	$\widetilde{A}_1=\left(a_2\|a_3\|\ldots\|a_{i-1}\|a_i\|a_{i+1}\|\ldots\|a_n\|a_{n+1}\right),$ $\widetilde{A}_2=\left(a_1\|a_3\|\ldots\|a_{i-1}\|a_i\|a_{i+1}\|\ldots\|a_n\|a_{n+1}\right),$ $\ldots$ $\widetilde{A}_i=\left(a_1\|a_2\|\ldots\|a_{i-1}\|a_{i+1}\|\ldots\|a_n\|a_{n+1}\right),$ $\ldots$ $\widetilde{A}_n=\left(a_1\|a_2\|\ldots\|a_{i-1}\|a_i\|a_{i+1}\|\ldots\|a_{n-1}\|a_{n+1}\right),$ $\widetilde{A}_{n+1}=\left(a_1\|a_2\|\ldots\|a_{i-1}\|a_i\|a_{i+1}\|\ldots\|a_{n-1}\|a_n\right).$

4	**Calculation the value of projections $\widetilde{A}_j$ in PNS** $\widetilde{A}_{\substack{jPNS\\ j=const}}=\left(\sum_{\substack{i=1\\ j=\overline{1,n+1}}}^{n}a_i\cdot B_{ij}\right)\bmod M_j$
	$\widetilde{A}_{1PNS}=\left(\sum_{i=1}^{n}a_i\cdot B_{i1}\right)\bmod M_1=\left(a_1\cdot B_{11}+a_2\cdot B_{21}+\ldots+a_n\cdot B_{n1}\right)\bmod M_1,$ $\widetilde{A}_{2PNS}=\left(\sum_{i=1}^{n}a_i\cdot B_{i2}\right)\bmod M_2=\left(a_1\cdot B_{12}+a_2\cdot B_{22}+\ldots+a_n\cdot B_{n2}\right)\bmod M_2,$ $\ldots$ $\widetilde{A}_{kPNS}=\left(\sum_{i=1}^{n}a_i\cdot B_{ik}\right)\bmod M_k=\left(a_1\cdot B_{1k}+a_2\cdot B_{2k}+\ldots+a_n\cdot B_{nk}\right)\bmod M_k,$ $\ldots$ $\widetilde{A}_{nPNS}=\left(\sum_{i=1}^{n}a_i\cdot B_{in}\right)\bmod M_n=\left(a_1\cdot B_{1n}+a_2\cdot B_{2n}+\ldots+a_n\cdot B_{nn}\right)\bmod M_n,$ $\widetilde{A}_{(n+1)PNS}=\left(\sum_{i=1}^{n}a_i\cdot B_{i(n+1)}\right)\bmod M_{n+1}=\left(a_1\cdot B_{1(n+1)}+a_2\cdot B_{2(n+1)}+\ldots+a_n\cdot B_{n(n+1)}\right)\bmod M_{n+1}.$

5	**Comparison the values** $\widetilde{A}_{\substack{jPNS\\ j=const}}=\left(\sum_{\substack{i=1\\ j=\overline{1,n+1}}}^{n}a_i\cdot B_{ij}\right)\bmod M_j$ **with module** $M=M_0/m_{n+1}$.

6	**Definition authentically undistorted $\left\{a_{z_j}\right\}$ and perhaps of distorted $\left\{\overline{a}_{z_j}\right\}$ residues of number $\widetilde{A}$**	
	$\left\{a_{z_j}\right\}\ j=\overline{l+1,n+1}$ $\widetilde{A}_{1PNS}\geq M\rightarrow a_1,$ $\widetilde{A}_{2PNS}\geq M\rightarrow a_2,$ $\ldots$ $\widetilde{A}_{nPNS}\geq M\rightarrow a_n.$	$\left\{\overline{a}_{z_j}\right\}\ j=\overline{1,l}$ $\widetilde{A}_{1PNS}<M\rightarrow\overline{a}_1,$ $\widetilde{A}_{2PNS}<M\rightarrow\overline{a}_2,$ $\ldots$ $\widetilde{A}_{nPNS}<M\rightarrow\overline{a}_n,$ $\widetilde{A}_{(n+1)PNS}<M\rightarrow\overline{a}_{n+1}.$

Fig. 1. Method of operative data diagnostic in RC

The combination in time the process definition and analysis (comparison of the projections in the PNS $\tilde{A}_{jPNS}$ with module M) values $\tilde{A}_{\substack{jPNS \\ j=const}} = \left(\sum_{i=1}^{n} a_i \cdot B_{ij} \right) \bmod M_j$ of the projections $\tilde{A}_j$ of the diagnosed number $A = (a_1 \| a_2 \| ... \| a_{i-1} \| a_i \| a_{i+1} \| ... \| a_n \| a_{n+1})$ allows increasing the efficiency of the procedure diagnosis data errors in the CDPD CN of TN in n time.

Consider the example using the method for the diagnosis in RC one-byte ($l = 1$) machine word (8 bits) the CDPD CN of TN. RC is given one control $m_k = m_{n+1} = 11$ and information m_1 = 3, m_2 = 4, m_3 = 5, m_4 = 7 bases.

In this case, provided the requirements of the uniqueness of the representation of the code words in this information numerically $[0, M)$ range.

For this RC we have: $M_0 = \prod_{i=1}^{n+1} m_i = 4620$ – the total number of code words in a given RC; $M = \prod_{i=1}^{n} m_i = 420$ – the number of information code words. In this case, the total (working) $[0, M_0)$ and the information $[0, M)$ numerical ranges defined respectively as $[0{,}4620)$, and $[0{,}420)$.

All possible sets of private bases RC are shown in tab. 1.

Table 1

Set of private working bases RC ($l = 1$)

j \ i	m_1	m_2	m_3	m_4	M_j
1	4	5	7	11	1540
2	3	5	7	11	1155
3	3	4	7	11	924
4	3	4	5	11	660
5	3	4	5	7	420

Suppose that in the course of transmission or data processing instead of the correct result $A_{RC} = (1\|0\|0\|2\|1)$ of the operation $A_{PNS} = 100 < M = 420$ was obtained number form $\tilde{A}_{RC} = (0\|0\|0\|2\|1)$, $\tilde{A}_{PNS} = 3180 > M = 420$. Necessary to conduct control and diagnostics of the number $\tilde{A}_{RC}$ (diagnosis his residues $a_i \left(i = \overline{1,5}\right)$).

I. The first stage.

1.1. Determine all values $B_i \left(i = \overline{1,5}\right)$ of orthogonal bases for a complete system of bases m_1 = 3, m_2 = 4, m_3 = 5, m_4 = 7 и m_5 = 11 RC (see tab. 2).

Table 2

Orthogonal bases B_i RC

$B_1 = (1,0,0,0,0) = 1540,\ \overline{m}_1 = 1$
$B_2 = (0,1,0,0,0) = 3465,\ \overline{m}_2 = 3$
$B_3 = (0,0,1,0,0) = 3696,\ \overline{m}_3 = 4$
$B_4 = (0,0,0,1,0) = 2640,\ \overline{m}_4 = 4$
$B_5 = (0,0,0,0,1) = 2520,\ \overline{m}_5 = 6$

1.2. Using the data in table 2, for the well-known [1] formula, determine the value of $\tilde{A}_{PNS}$:

$$\tilde{A}_{PNS} = (0 \cdot 1540 + 0 \cdot 3465 + 0 \cdot 3696 + 2 \cdot 2640 + 1 \cdot 2520) \bmod 4620 = \\ = 3180 (\bmod 4620)$$

1.3. Perform comparison value number $\tilde{A}_{PNS}$ and $M = 420$. So, how $\tilde{A}_{PNS} > M = 420$, it is concluded that the obtained result $\tilde{A}$ distorted by any one of the residues a_i correct number $A_{RC} = (1\|0\|0\|2\|1)$.

II. The second stage.

2.1. We define the values private B_{ij} orthogonal bases for each of the 5 sets of bases RC. Thus, for $i = 4$ and $j = 5$, we have:

$$\begin{cases} B_{1j} = (1,0,0,0), \\ B_{2j} = (0,1,0,0), \\ B_{3j} = (0,0,1,0), \\ B_{4j} = (0,0,0,1). \end{cases}$$

In general, the values B_{ij} the private orthogonal bases determined according to the following comparison $B_{ij} = \frac{M_i \cdot \overline{m}_{ij}}{m_i} \equiv 1 (\bmod m_i)$, where $\overline{m}_{ij} \equiv \overline{1, m_i - 1}$ – the weight of an orthogonal basis B_{ij}. The results of calculations of values B_{ij} the private orthogonal bases are presented in tab. 3.

Table 3

Private orthogonal bases B_{ij} for $l = 1$

B_{ij} \ i / j	1	2	3	4
1	385	616	1100	980
2	385	231	330	210
3	616	693	792	672
4	220	165	396	540
5	280	105	336	120

2.2. Determine the correct of residues number $\tilde{A}$. At first, we form all possible projection A_j number $\tilde{A}_{RC} = (0\|0\|0\|2\|1)$:

$$\begin{cases} \tilde{A}_1 = (0\|0\|2\|1), \\ \tilde{A}_2 = (0\|0\|2\|1), \\ \tilde{A}_3 = (0\|0\|2\|1), \\ \tilde{A}_4 = (0\|0\|0\|1), \\ \tilde{A}_5 = (0\|0\|0\|2). \end{cases}$$

Using the data from table 3, we represent the values of the projections $\tilde{A}_j\left(j = \overline{1,5}\right)$ number $\tilde{A}_{RC} = (0\|0\|0\|2\|1)$ in PNS:

$$\tilde{A}_{1PNS} = (a_1 \cdot B_{11} + a_2 \cdot B_{21} + a_3 \cdot B_{31} + a_4 \cdot B_{41}) \bmod M_1 =$$
$$(0 \cdot 385 + 0 \cdot 616 + 2 \cdot 1100 + 1 \cdot 980) \bmod 1540 = 100 < 420.$$
$$\tilde{A}_{2PNS} = (a_1 \cdot B_{12} + a_2 \cdot B_{22} + a_3 \cdot B_{32} + a_4 \cdot B_{42}) \bmod M_2 =$$
$$(0 \cdot 385 + 0 \cdot 231 + 2 \cdot 330 + 1 \cdot 210) \bmod 1155 = 870 > 420.$$
$$\tilde{A}_{3PNS} = (a_1 \cdot B_{13} + a_2 \cdot B_{23} + a_3 \cdot B_{33} + a_4 \cdot B_{43}) \bmod M_3 =$$
$$(0 \cdot 616 + 0 \cdot 693 + 2 \cdot 792 + 1 \cdot 672) \bmod 924 = 418 < 420.$$
$$\tilde{A}_{4PNS} = (a_1 \cdot B_{14} + a_2 \cdot B_{24} + a_3 \cdot B_{34} + a_4 \cdot B_{44}) \bmod M_4 =$$
$$(0 \cdot 220 + 0 \cdot 165 + 0 \cdot 396 + 1 \cdot 540) \bmod 660 = 540 > 420.$$
$$\tilde{A}_{5PNS} = (a_1 \cdot B_{15} + a_2 \cdot B_{25} + a_3 \cdot B_{35} + a_4 \cdot B_{45}) \bmod M_5 =$$
$$(0 \cdot 280 + 0 \cdot 105 + 0 \cdot 336 + 2 \cdot 120) \bmod 420 = 240 < 420.$$

Among all the obtained projections $\tilde{A}_i$ number $\tilde{A}$ projections $\tilde{A}_1$, $\tilde{A}_3$ and $\tilde{A}_5$ less than the value $M = 420$, but projections $\tilde{A}_2$ and $\tilde{A}_4$ is greater than $M = 420$. Consequently, the result of an incorrect diagnosis $\tilde{A}$ number will be the following assertion. Among the five residues number $\tilde{A}_{RC} = (0\|0\|0\|2\|1)$ is the residues of a_1, a_3 and a_5 may be wrong, and the residues of a_2 и a_4 – are not distorted.

It is known that the efficiency of diagnosis is convenient to characterize such a quantitative indicator, the depth D of diagnosis. In the RC depth D diagnosis data we mean the level of detail location of an error in the NCS on the form $A = (a_1\|a_2\|...\|a_{i-1}\|a_i\|a_{i+1}\|...\|a_n\|a_{n+1})$, consisting of a set of residues $\{a_i\}, i = \overline{1, n+1}$.

As noted above, it is assumed single (only one residue of NCS) error.

Quantitatively, the depth diagnostics data D in RC can be evaluated by the relation $D = 1/r$, where r – the number m_{z_i} of residues $\{m_{z_1}, m_{z_2}, ..., m_{z_r}\}$ that can be a mistake. The maximum value of depth $D_{\max}$ diagnosis is achieved when an error in NCS A is detected with accuracy to one residue. In this case, the maximum depth $D_{\max}$ diagnosis to mean the identification of one ($r = 1$) residue NCS A, which contains the error, i.e., $D_{\max} = 1/r = 1$.

For the above example the number of diagnosis $\tilde{A}_{RC} = (0\|0\|0\|2\|1)$ we have that $r = 3$, i.e. $D = 1/3 \approx 0{,}33$.

3. Conclusion

In this article improved the method of diagnostic in RC, which basis on the use orthogonal bases B_{ij} of the private set of modules. Orthogonal bases B_{ij} formed from complete system of bases m_i $(i = \overline{1, n+1})$. Their use makes it possible to organize the process of parallel processing projections $A_i = (a_1\|a_2\|...\|a_{i-1}\|a_{i+1}\|...\|a_n\|a_{n+1})$ number $A = (a_1\|a_2\|...\|a_{i-1}\|a_i\|a_{i+1}\|...\|a_n\|a_{n+1})$ of the code structure in RC. This allows to raise the efficiency of diagnosis data in RC.

Implementation the process of diagnostic data errors in RC is shown in the example. The proposed method has allowed increasing the efficiency of the diagnostic data errors in the CDPD CN of TN operating in RC.

References

1. Акушский И.Я., Юдицкий Д.И. Машинная арифметика в остаточных классах. – М.: Сов. радио, 1968. – 440с.
2. Davis R.G., Yocke R.A. Residue coded signals and applications to space technology. Proc. of the 6 th symposium on ballistic missile and aerospace technology, 1961, p. 215 - 245.
3. Valach M. Origin of the code and number system of remainder classes. Stroje na zpracovani informaci. Sbornik III, 1955
4. Мороз С. А., Краснобаев В.А. Метод контроля информации в непозиционной системе счисления класса вычетов // Системи управління, навігації та зв'язку. – 2011. – Вип. 2 (18). – С. 134-138.
5. Краснобаев В. А., Маврина М. А., Кошман С. А. Контроль, диагностика и исправление ошибок данных, представленных кодом класса вычетов// Збірник наукових праць. Системи обробки інформації. – Харків: НАНУ ПАНМ, ХУПС. 2013. – Вип. 2. (109). – С. 48 - 54.

Краснобаев В.А., Маврина М.А. Метод оперативной диагностики ошибок компьютерных устройств обработки данных коммутационно-коммуникационного узла телекоммуникационной сети, функционирующих в классе вычетов. Предложен метод оперативной диагностики данных, представленных в непозиционной системе счисления класса вычетов.

Ключевые слова: класс вычетов, коммутационно-коммуникационный узел, телекоммуникационная сеть, компьютерные устройства обработки данных, оперативная диагностика данных.

Краснобаєв В.А., Мавріна М.О. Метод оперативної діагностики помилок комп'ютерних пристроїв обробки даних комутаційно-комунікаційного вузла телекомунікаційної мережі, що функціонують у класі лишків. Запропоновано метод оперативної діагностики даних, що представлені у непозиційній системі числення класу лишків.

Ключові слова: клас лишків, комутаційно-комунікаційний вузол, телекомунікаційна мережа, комп'ютерні пристрої обробки даних, оперативна діагностика даних.

Поступила 05.12.2014 г.