W-cyclic method interleaving of the data for communication systems

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Currently communication systems require high speed transmission and transformation of information with ensuring the required level of reliability. But the influence of noise leads to appearance module errors [1]. Therefore, for reliable information processing in many communication channels are used scheme, based on correcting codes and interleavers.

Interleaving procedure reduces the correlation between adjacent symbols, which allows to convert a module errors to single. The most famous interleavers are the block, s-random and cyclic interleavers [2]. The advantage of cyclic interleaver is a small time bit interleaving.

The function of the cyclic interleaving is as follows:

$$\pi(i) = i \cdot a \bmod N, \tag{1}$$

where $a < \left\lfloor \sqrt{2 \cdot N} \right\rfloor$ – the step, that determines the distance between two neighboring bits after interleaving. Besides parameters values of *a* and N must be coprime.

The investigation showed that due to different step values cyclic interleaver has different properties. As shown in Fig. 1, with step size a = 31 cyclic interleaver can spread errors high multiplicity to the relatively small distance, with a = 251 cyclic interleaver shows excellent results at a low multiplicity of errors, but at a higher multiplicity of the depth of errors diversity is low.

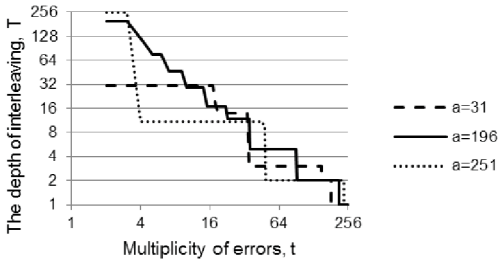

Fig. 1. The curves of minimum separation distances errors by cyclic interleaver with different values of the step at N = 512

Therefore, it is expedient to improve the cyclic interleaver with the aim of separation to long distances errors of high multiplicity and low multiplicity (a = 196 for N = 512). It is proposed to use the following function, as a modification of cyclic interleaver:

$$\pi(i) = i \cdot W \bmod(N+1), \tag{2}$$

where W – is an integer number, prime to (N+1). Experimentally established that the with step $W = \left\lfloor 0{,}382 \cdot N \right\rfloor$ (where 0.382 – Fibonacci ratio) interleaver carries errors of any multiplicity very well.

References

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