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ERROR-CORRECTION DECODING OF BLOCK TURBO-PRODUCT CODES IN DISTRIBUTED COMPUTER SYSTEMS

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Анотація
У даній роботі проаналізовано особливості декодування завадостійких блокових кодів турбо-добутків.
Ключові слова: завадостійке кодування, код турбо-добуток, декодування, кодек, списковий декодер.

Abstract
This paper analyzes the features of decoding an error-correcting block turbo-product codes.
Keywords: error-correcting coding, turbo-product code, decoding, codec, list decoder.

Introduction

The development of methods and tools of information protection based on error-correcting coding is gaining particular importance and relevance. In 1994, it was proposed to use block turbo-product codes, which are more effective than convolutional turbo codes for transmitting information at relatively high code rates [1, 2]. The *aim* of the work is to analyze the features of the operation of block turbo-product codes in data transmission systems.

Research results

When decoding these codes, the original data is written to a two-dimensional array in rows, then encoded in rows using the first code, and then the data and check bits of the first code are encoded in columns of the second code. The iterative procedure for decoding such a code is two-stage – horizontal and vertical decoding. The list decoding method is effective, as it uses a set of vectors, changes the least reliable symbols in them, and decodes each word with a hard decoder. After that, the similarity metrics M_i of the competing words c_{ij} are calculated and the best of them M_{pp} is determined. After that, the reliability of each symbol in the bit sequence is calculated, using the obtained sequence c_{pp} and the list of code words [3]:

$$LLR_j = 0{,}25 \cdot (\min\{M_i, c_{ij} \neq c_{pp,j}\} - M_{pp}) \cdot (2c_{pp,j} - 1). \quad (1)$$

If there are no competing words for which the bit j does not differ from $c_{pp,j}$, then the reliability of LLR_j has a fixed value β. Next, it is necessary to update the information entering the decoder at iteration q according to the expression [4, 5]:

$$w_j^q = r_j + \alpha \cdot E_j^q, \quad (2)$$

where $\alpha = [0.0; 0.2.; 0.3; 0.5; 0.7; 0.9; 1.0; 1.0; ...]$.

Conclusions

The paper analyzes a mathematical model of the iterative process of decoding block turbo-product codes, which can be implemented in software.

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