Computer-Aided Design of Digital Radio Devices with Frequency Representation of Information

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Abstract - **This paper presents a system of automated design of digital radio devices with frequency representation of information, which can significantly simplify the design process of digital devices with large number of input signals.**

Keywords - **Automated design, frequency representation of information, digital information processing.**

I. INTRODUCTION

Application of digital radio devices with pulse-frequency processing for television, telephone and radio signals will significantly increase the noise immunity of information processing systems comparing to pulse-potential representation and eliminate one of the main disadvantages of this method - the need for direct transmission of signals with low-frequency components of spectrum [1]. In work [2] the method of synthesis of such devices is represented, one of the most important steps is to build combined table that is truth table columns supplemented with columns of complete interim results, functions of rejection and membership functions.

II. AUTOMATED DESIGN OF DIGITAL RADIO DEVICES

In this paper authors proposed the algorithm for constructing tables of correspondence for the automated synthesis of digital radio devices with a frequency representation of information for the case of binary structural alphabet. The essence of the algorithm as follows. The number of table lines is determined by the expression: $K_c=2^n$, where n - number of input device. The number of columns can be calculated by the expression K_r=n +2 + m + p, where m - number of input signals, p - number of outputs. Value of CIR are imported in two columns, which are determined by the formula:

$$z_i = w_{i1} + w_{i2} + \mathbf{K} + w_{in} = \sum_{j=1}^{n} w_{ij} \qquad (1)$$

and value of the deviation functions:

$$\Delta_i = z_i - y_i \qquad (2)$$

Contents of each of the n columns can be calculated as follows. The first column contains $2^n/2$ frequency ω_0, corresponding to a logic zero and $2^n/2$ frequency ω_1, which corresponds to the logical one. The second column depends on the content of the first $2^n/4$ lines containing frequency ω_0, the second $2^n/4$ - ω_1, the third $2^n/4$ - ω_0 and the fourth $2^n/4$ lines contain ω_1. The third column is defined as follows: the first $2^n/8$ lines containing frequency ω_0, the second group of lines containing $2^n/8$ frequency ω_1, the third $2^n/8$ contains frequency ω_0 and so on. Content of the last column contains sequences of frequencies ω_0 and ω_1.

Synthesis algorithm of digital devices using the frequency representation of information is performed in sequential stages:

1. Defining the type of frequency-logic function. At this stage the type of output function is determined: clearly dependent or ambiguously dependent.

2. Definition of auxiliary signals. For all frequency sets the value of Δ_i is determined for the function of deviation Δ.

3. For each of g membership function its value is determined by the formula:

$$C_{ij} = \begin{cases} 1, \ if \ \ \Delta_i = \Delta_j \\ 0, \ if \ \ \Delta_i \neq \Delta_j \end{cases} \qquad (3)$$

Actions performed on stages 1 - 3 can be conveniently presented in the form of combined table.

TABLE 1

COMBINED TABLE

x_1	x_2	◣	x_n	y	Z	Δ	x_2	C_2	◣	C_g

4. Definition of filtering functions values.

5. Compiling operator descriptions. Operator description is based on the structure of the generalized operator descriptions.

6. Building the block diagram. Block diagram of digital devices is based on the generalized structure. Thus, each operator symbol of description or their complex is put into corresponds to physical scheme or connection.

III. CONCLUSION

Developed software implemented algorithm to generate structure circueits for DD is based on the developed method of structural synthesis of DD with the pulse-frequency information representation, which enables simplification of block diagram compared with the same digital device, synthesized by the traditional method using as the basis logic elements,.

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