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A METHOD FOR GENERATION OF THE FULL CLASS OF PERFECT BINARY ARRAYS OF THE ORDER $N = 8 \times 8$

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The paper presents a new constructive method for generation of the full class of perfect binary arrays of the order $N = 8 \times 8$, with exact estimation of its power. The method can be extended to the case of $N > 8$.

Considerable recent attention has been focused on applications of perfect binary arrays (PBA) in a number of radio-engineering problems, for example: synthesis of antenna apertures; generation of perfect frequency-time codes; generation of the full class of block-type correcting codes; generation of new classes of orthogonal, biorthogonal, and minimax signals with the property of multiloop cyclic shift, etc. At the same time, many relevant issues require further investigation: particularly, there is no solution to the problem of exact estimation of power of full classes of PBA of a given order $N = 2^k$, or $N = 3 \cdot 2^k$, for an arbitrary integer k.

The perfect binary arrays represent two-dimensional tables (matrices), consisting of N_1 rows and N_2 columns, of rectangular or square shape:

$$H = \|h_{i,j}\|, \ i = \overline{0, N_1 - 1}, \ j = \overline{0, N_2 - 1}, \ h_{i,j} \in \{-1, +1\}, \tag{1}$$

having an ideal two-dimensional periodic autocorrelation function (TPACF), whose elements

$$R(m,n) = \sum_{i=0}^{N_1-1} \sum_{j=0}^{N_2-1} h_{i,j} h_{i+m,j+n} = \begin{cases} N_1 \cdot N_2, & \text{at } m = n = 0, \\ 0, & \text{for other } m \text{ and } n. \end{cases} \tag{2}$$

A great number of works are devoted to the search for PBA and investigation of their structural properties [1–4]. Note, however, that the known methods of PBA synthesis cannot help synthesize full $U(N)$-classes of PBA for a prescribed order N — $N = 2^k$ or $N = 3 \cdot 2^k$ — for arbitrary integers k. Moreover, at the present time we do not know the power of full classes of PBA for many dimensions ($N_1 \times N_2$). For example, in [4] the estimate of the power of the full class of PBA of order $N = 3 \cdot 2^1 = 6$ was established. In [2], based on the spectral approach, and then in [3], with the use of the time (correlative) approach, the estimate of the power of the full class of PBA of order $N = 2^k$ was obtained:

$$W(N) = W(2^k) = \begin{cases} 3^{k/2} 2^{2^{k+1}-1}, & \text{for even } k, \\ 3^{(k-1)/2} 2^{2^{k+1}-1}, & \text{for odd } k. \end{cases} \tag{3}$$

It follows from (3) that

$$W(2^1) = 2^3 = 8, \ \ W(2^2) = 3 \cdot 2^7 = 384, \ \text{and} \ \ W(2^3) = 3 \cdot 2^{15} = 98304.$$

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