Class of Minimax Error-Corecting Codes Based on Perfect Binary Arrays

M. I. Mazurkov

Odessa National Polytechnic University, Odessa, Ukraine
Received in final form June 22, 2011

Abstract—A regular synthesis method has been developed for synthesizing infinite families of minimax $M(N)$-classes of perfect binary arrays having order $N = 2^k$, where k is arbitrary natural number. This method enabled us to construct a new class of four-parameter minimax error-correcting $M(n)$-codes having length $n = N^2$ that possess many practically attractive properties; in this case the task of decoding is reduced to the effective procedure of majority estimation of parameters of the received code words

In recent years the heightened attention in the domestic and foreign literature has been paid to the application issues of perfect binary arrays (PBA) in solving different radio engineering problems [1–6]. For example, Such problems include, for example, the synthesis of antenna aperture, the construction of perfect frequency-time codes [7], construction of new classes of the orthogonal, biorthogonal, and minimax signals having the property of two-loop cyclic shift, construction of new kinds of orthogonal transformations [8], development of new methods for information security [9–11], etc. At the same time, the issues of the regular construction of minimax classes of PBA and minimax error-correcting codes based on the above classes have not been tackled in literature.

The purpose of the present paper is to develop a regular synthesis method for synthesizing infinite families of minimax $M(N)$-classes of perfect binary arrays having order $N = 2^k$, where k is arbitrary natural number, and to construct on this basis a new class of multiparamter minimax error-correcting $M(n)$-codes having length $n = N^2$.

The material of the paper is presented in two parts. The first part deals with the development of a regular synthesis method for synthesizing infinite families of minimax $M(N)$-classes of perfect binary arrays having order $N = 2^k$, while the second part, based on this method, deals with the proposal and investigation of a new class of minimax nonlinear error-correcting $M(n)$-codes having the length $n = N^2$.

1. SYNTHESIS OF INFINITE FAMILIES OF MINIMAX $M(N)$-CLASSES OF PBA

DEFINITION 1.1

A pair of PBA having the same order N and presented in the form of their thinned matrices [6]

$$H_i(N) = A_0 \cup B_i \cup C_i \cup D_i,$$

$$H_k(N) = A_0 \cup B_k \cup C_k \cup D_k \tag{1}$$

is called optimal if no more than one matching of structures of the thinned matrices occurs at all N^2 cyclic shifts in terms of rows and columns of one of the arrays and the superposition of these PBA on one another (parameter $\lambda \leq 1$).