Radioelectronics and Communications Systems
Vol. 47, No. 12, pp. 11–13, 2004

Izvestiya VUZ. Radioelektronika
Vol. 47, No. 12, pp. 17–20, 2004
UDC 621.391.2

THE CLASS OF OPTIMAL SYSTEMS OF DF-SIGNALS BASED ON *M*-SEQUENCES IN THE EXTENDED GALOIS FIELDS

M. I. Mazurkov and V. S. Dmitrenko

Odessa National Polytechnic University, Ukraine

A regular rule is suggested for the construction of optimal systems of discrete-frequency signals without repeated frequencies over arbitrary extended Galois fields $GF(q)$, $q = p^m$, with the following parameters: $N = q - 1$ is the signal length; $J = q - 1$ is the power of the optimal system of discrete-frequency signals; $M = q$ is the number of different frequencies for setting-up the optimal systems of DF-signals.

The signals with pseudorandom readjustment of working frequency (PRWF), or the signals with “frequency jumps” have found in our days wide application in the systems of information transmission and radiolocation [1–3]. The properties of PRWF-signals depend to a large measure on structural properties of multilevel numerical sequences (MNS). As a result, at the present time the scientific literature gives a number of reports devoted to the search for new types of MNS permitting to resolve some or other tasks. The purpose of the present paper is to develop a regular rule for construction of optimal, by the criterion of no more than one coincidence [1, 2], systems of combinative MNS over the extended Galois fields.

Let $GF(q)$, $q = p^m$ be the extension of the power m of a simple field $GF(q)$, and the element $a \in GF(q^m)$. By the trace tr a of the field $GF(q^m)$ is meant the sum

$$\operatorname{tr} a = \sum_{k=0}^{m-1} a^{p^k}. \qquad (1)$$

It is known [4] that tr $a \in GF(q^m)$ and, if a runs over the whole field $GF(q^m)$, then the trace tr a takes every value from $GF(q)$ exactly p^{m-1} times.

Definition 1. A sequence of p-ary numbers

$$M(p) = \{f_i\} = \{\operatorname{tr} \theta^i\},\ i = \overline{0, q-2}, \qquad (2)$$

where θ is the primitive element of the field $GF(q)$, $q = p^m$, will be called the p-ary sequence of a maximal period $\varepsilon = q - 1$, or the $M(p)$-sequence.

Definition 2. A sequence of q-ary numbers

$$M(q) = \{\omega_i\},\ i = \overline{0, q-2}, \qquad (3)$$

where

$$\omega_i = \sum_{k=0}^{m-1} f_{i+k} \cdot p^{m-k-1} \qquad (4)$$

or

REFERENCES

1. A. I. Zamarin and A. V. Andreyev, Zarubezhnaya Radioelektronika, No. 5, pp. 3–12, 1993.
2. L. Ye. Varakin, Communication Systems with Noise-Like Signals [in Russian], Radio i Svyaz', Moscow, 1985.
3. B. M. Zlotnik, Noise-Immune Codes in Communication Systems [in Russian], Radio i Svyaz', Moscow, 1989.
4. V. P. Ipatov, Periodic Discrete Signals with Optimal Correlative Properties [in Russian], Radio i Svyaz', Moscow, 1992.
5. R. Blayhuth, Theory and Practice of Error-Checking Codes [Russian translation], Mir, Moscow, 1986.
6. I. M. Vinogradov, Foundations of the Number Theory [[in Russian], Nauka, Moscow, 1981.
7. N. N. Klimenko, V. V. Kisel', and A. I. Zamarin, Zarubezhnaya Radioelektronika, No. 11, pp. 45–59, 1983.

25 June 2004