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УДК 519.216.1 **Information Control Systems and Technologies, pp. 230-232**

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INFORMATION TECHNOLOGIES IN MODERN NONLINEAR DYNAMICAL SYSTEMS

It is known that the creation of effective control methods in all known forms is possible upon the condition that information on the laws of evolutionary development does exist and available [1]. The accumulation, processing and analysis of information, as a rule, is a stochastic nature of the laws of its processing and application [2]. One of the most common formation, processing and analysis systems is self-organized nonlinear dynamic systems. At the same time nonlinear dynamic systems can be used to provide an approach to problems and tasks that involve notion of randomness. An example of such a task is the Monte Carlo method, which raised the question whether or not it is really necessary to use true chance or can it be replaced by an appropriate deterministic procedure for the solution? The theorem is proposed in [3], provided that any settlement problem is difficult to solve, randomness does not allow to improve algorithmic efficiency. The question arises whether it is possible to effectively form such sequences that would be close to random by means of deterministic methods. This problem can be solved both in terms of mathematics and in terms of computer science.

To investigate and analyze previously stated problems this paper considers the processes observed in a group of nonlinear maps that represents behavior of nonlinear dynamical systems:

$$t_1(x_n) = x_{n+1} = \begin{cases} 2x_n, & 4x_n < p \\ p - 2x_n, & 4x_n \geq p \end{cases}; \qquad t_2(x_n) = x_{n+1} = \begin{cases} 2x_n, & 2x_n < p \\ p - x_n, & 2x_n \geq p \end{cases}$$

$$t_3(x_n) = x_{n+1} = \begin{cases} 2x_n, & 2x_n < p \\ 2x_n - p, & 2x_n \geq p \end{cases}; \qquad t_4(x_n) = x_{n+1} = \begin{cases} 4x_n, & 4x_n < p \\ 4x_n \pmod{p}, & 4x_n \geq p \end{cases},$$

The structure of iterative cycles is determined not only by the properties of the maps itself, but also by the properties of the numbers that are used and which have a significant influence on the structure and can significantly change it. However, considering the internal structure, it is necessary to introduce some similarity measure for the internal structures to conduct more complete analysis. There are several approaches to determining randomness and, accordingly, methods for evaluating the degree of randomness of a particular sequence. In [4], four algorithmic properties are differed for the description of randomness: frequency stability, chaotic behavior, typicality, nonpredictability.

Given the internal structure of the sequences derived from the above-mentioned maps, there is a problem of finding and evaluating such structures. The first type of similarity measurement evaluates and compares the overall shape of the sequences based on the actual values of the sequence. However, such measures do not identify the similarity of sequences if they are not aligned with the *X* axis. This fact leads to another group of measures, that are characteristic measures among which the main is the discrete Fourier transform (DFT).

In this paper we consider the application of measures of form estimation and DFT measure as an example of the characteristic measure, since they provide a simple process for the implementation of calculations and allow us to draw conclusions about the internal structure of the sequences considered in this paper. As a rigid step-by-step measure, the measure is based on the correlation coefficient. To evaluate the internal structure of the sequences derived from maps it was used method that allows to obtain a hierarchy of internal cycles according to the length of the cycle, as well as the degree of similarity of the found structures.

The results of the work show that the best approximation to the requirements of probability theory with the use of nonlinear dynamic maps is provided by analyzing the power of the set of numbers on which the generator is based. The best results in the number of such internal cycles show sequences based on the map (4), which confirms the results previously obtained for this mapping, when statistical tests were used to estimate the randomness measure. For reliable pseudorandom generation methods should be considered maps that

generate sequences with fewer similar internal structures and smaller lengths of these subsequences.

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УДК. 629.123 **Information Control Systems and Technologies, pp. 232-234**

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УПРАВЛЕНИЕ ПРОЦЕССОМ ВЕНТИЛЯЦИИ ТРЮМОВ ТАНКЕРА

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CONTROL OVER THE TANKER'S HOLDS VENTILATION PROCESS

На танкерах при помощи технологического контура производства и подачи инертных газов (ИГ) в грузовые трюма обеспечивается поддержание пожаро- и взрывобезопасносной микроатмосферы. Движение ИГ - продуктов сгорания дизеля может осуществляться в грузовых помещениях судна двумя путями: за счет естественной диффузии и принудительно с использованием различных технологических схем.

Для повышения рентабельности работы судна за счет эффективного управления скоростью и качеством процесса вентиляции грузовых помещений особо важной является проблема разработки или совершенствования системы автоматизированного управления. Работа всех систем контроля и регулирования должна в первую очередь определяться условиями рабочего процесса и конструктивными особенностями грузовых помещений танкера.