Review of the Book “Non-Traditional Dynamics: Theory and Practice”

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The offered book is devoted to theoretical and applied problems of nonlinear dynamics of radio physical systems. The main goal of this book is theoretical and experimental investigations of key principles and laws of radio physical system’s functioning with continuous and discrete time, in which both regular and chaotic oscillation types may occur.

Modern radio physics and radio engineering, as it follows from scientific publications, feels the increased necessity in the sources of wide-band noise-like oscillations. This necessity is caused by possibility to create on this basis the systems of electronic counter measures and radio masking, the noise-like radar technology and confidential communications, ultra-fast radio communications, cryptographic structures, devices for non-traditional interaction on biologic objects, various devices of special applications. All this is evidence of the fact that investigations directed to examination of dynamic instabilities and the determined chaos are quite relevant. Therefore, the urgency of this book and its practical significance cannot present any doubts.

The book consists of six chapters. The first chapter is devoted to the mathematical model of non-autonomous oscillating system contained the nonlinear capacitor and having the four-dimension phase space. Numerical investigation is conducted for bifurcation phenomena and processes occurring at variations of amplitude and frequency of the external force. It is proved that in the phase space of the system under investigation both strange chaotic attractors and the strange non-chaotic attractors exist. Numerical results are confirmed by the full-scale experiments.

The typical features of transition from regular types of oscillations to chaotic ones in the self-oscillating systems of oscillator and relaxation types are discussed in the second chapter. It is proved that for definite type of these systems non-linearity the chaotization of motions happens according to one auto-parametric scenario. Numerical results are confirmed by experimental results fulfilled on the basis of radio physical oscillating systems.

The new spectral-temporal method for the analysis of oscillating systems is discussed in the third chapter. Peculiarities of construction of the mathematical model suitable for physical analysis are discussed, which describe motions in the discrete and distributed dynamical systems. It is shown that if such systems are physically realizable, the processes in them can be described by identical systems of spectral-time equations. The comparative analysis is executed for natural fluctuations of oscillating systems with delay and Thomson-type. The direct approach of spectrum calculation of Lyapunov characteristic exponents for systems with delayed feedback.

Boundaries and the attraction basin of the time series attractor caused by modified logistic map are determined in the fourth chapter. Values of the control parameter, which divide regular chaotic types of oscillations and strictly-chaotic ones are found out. It is shown that at arising of the chaotic motion the control parameter behavior corresponds to the phase transition of the second
A series of algorithms of noisy sequence generation with accurately predicted statistical characteristics is suggested. The nonlinear dynamics of two coupled modified logistic maps is examined. Bifurcation phenomena and processes are studied in detail. Two unknown earlier phenomena are described. The first one is arising the “intermittent synchronization” of two chaotic processes. The second one is formation in the phase space the geometrically ordered structures at strictly positive value of the Kolmogorov-Sinai entropy.

Promising directions of UHF generating structures having high and uniform spectral density in the wide frequency range are investigated in the fifth chapter. The possible methods of such system constructions are analyzed. On the basis of the last achievements of nonlinear chaotic dynamics, the variant of creation the source of the determined chaotic oscillations is offered intended for angular modulation of quasi-sinusoidal oscillator of UHF range. Numerical modeling results as well as results of physical experiments are discussed. A series of issues of robust systems for confidential communication with the chaotic carrier frequency is examined. New principles of double-channel systems with active and passive synchronization are described. The investigation results fort frequency-modulated systems of chaotic communication are given.

Some problems, in which the mutual understanding of experts working in the field of nonlinear dynamics is absent, are investigated in the sixth chapter. To eliminate a series of ambiguities, authors offer the classification of physical systems, objects and processes based on attraction the concept of an openness degree and the reproduced motion type. The influence of the white noise with normal and uniform distribution laws and chaotic sequences with necessary value of metric entropy.

REFERENCES

This review proposes an interpretation of the theories outlined in the book and seeks to emphasize the importance of the author's conclusions for valuation studies, new economic sociology and especially for studying the performative side of economic theory. The first part of the paper suggests the deeper historical roots of Imagined Futures.