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New generalized chaos-geometric and neural networks approach to nonlinear modeling of complex chaotic dynamical systems

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Abstract: We present a new generalized approach to modelling nonlinear processes of chaotic systems based on the known concept of compact geometric attractors (CGA), chaos theory methods plus implemented neural networks (NNW) simulation algorithm. The basic idea of the construction of prediction approach to chaotic properties of complex systems is in the use of the traditional concept of a CGA in which evolves the measurement data, plus the NNW quantum algorithm implementation. In terms of the neuro-informatics and neural networks theory the process of modelling the evolution of the system can be generalized to describe some evolutionary quantum dynamic neuro-equations. The main blocks of the combined approach (technology) are as follows (in [1,2]): I. General analysis and evolutionary differential equations treatment; II. Study of presence of chaos (Test by Gottwald-Melbourne. Fourier decompositions. Spectral analysis; III. The geometry of the phase space. Multi-fractal spectra. Wavelet analysis; IV. Processing and Prediction methods and algorithms (nonlinear parameterized function; optimized trajectories (propagators) algorithms; Neural Networks algorithms (technology). References. [1] Glushkov A.V.: Methods of a chaos theory , Odessa, Astroprint (2012). [2] Khetselius O.Yu.: Forecasting evolutionary dynamics of chaotic systems using advanced non-linear prediction method. In: Dynamical Systems Applications, Eds.: J. Awrejcewicz, M. Kazmierczak, P. Olejnik, J. Mrozowski (Lodz, Poland) 2013. Vol. T2, 145-152.

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