E. Yu. Romanenko (Institute of Mathematics,
National Academy of Sciences of Ukraine, Kyiv)

Statistical description of chaotic solutions for continuous-time difference equations

The nonlinear continuous-time difference equations

$$x(t+1) = f(x(t)), \quad t \in R^+,$$

where f is a continuous interval map, posses a number of properties that are nonstandard from the differential equations (both ordinary and retarded) theoretical standpoint. In the report, the case at hand is perhaps the most "exotic" of these: The existence of the so-called *self-stochastic solutions* — deterministic intricate behavioral functions (that become unpredictable with time) whose long-term behavior can be described with certain random processes. For short, this description implies that *the ε-averaged finite-dimensional distributions of a self-stochastic solution are close to the ε-averaged finite-dimensional distributions of the corresponding random process when time is large enough.* Moreover, if ε is sufficiently small but not-too-small, the ε-averaged distributions of the solution can be approximated even by the ordinary (non-averaged) distributions of the random process.

The above-mentioned studies are based on the results concerning the self-stochasticity phenomenon in the (infinite-dimensional) dynamical system $\varphi \mapsto f \circ \varphi$ that acts in the space of initial functions $\varphi(x)$, $x \in [0,1]$, of the difference equation.

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