Theory of Dynamical Systems with Some Applications for Finite Dimensional, Infinite Dimensional and Discrete Dynamical Systems

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In the papers [1, 2], the following original dynamical systems were considered. The finite dimensional (superintegrable) dynamical system:

$$\dot{x}_n = \gamma_n \sum_{m=1}^{p} (e^{x_{n+m}} - e^{x_{n-m}}),\ 1 \leq n \leq N,\ x_{n+N} = x_n. \tag{1}$$

The infinite dimensional dynamical system:

$$\begin{aligned} i\psi_t &= -\Delta\psi + V\psi, \\ iV_t &= \Delta V - \frac{V^2}{2}. \end{aligned} \tag{2}$$

Discrete dynamical systems (Quanputers):

$$\begin{aligned} S_n(k+1) &= \Phi(S(k)), \\ l_n(k+1) &= l_m M^{-1}_{mn}(S(k+1)), \end{aligned} \tag{3}$$

where $S_n(k), 1 \leq n \leq N(k)$, is the state vector of the system at the time step k and

$$M_{nm} = \frac{\partial \Phi_n(S(k))}{\partial S_m(k)}, \tag{4}$$

is regular, i.e. has an inverse. If the matrix is not regular, this is the case, for example, when $N(k+1) \neq N(k)$, we have an irreversible dynamical system (usual digital coputer and/or corresponding irreversible gates).

References

[1] N. Makhaldiani, *Nambu-Poisson Dynamics and its Applications*, in Global Analysis and Applied Mathematics, AIP Conference Proceedings, Volume 729, p. 355, New York, 2004.

[2] N. Makhaldiani, *Nambu-Poisson dynamics of superintegrable systems*, presented at the Second international Workshop, Dubna, June 27- July 1, 2005, the text in preparation.

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