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Deterministic chaos, bifurcations and strange attractors in nonlinear dynamics of relativistic backward-wave tube

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Abstract: We present the results of analysis, modeling and forecasting a chaos elements, bifurcations and strange attractors characteristics in a temporal dynamics for relativistic backward-wave tube (RBWT) with accounting relativistic effects (g=1.5-6), dissipation (factor D), space charge effect etc. The advanced dynamical model is presented and the temporal dependencies of the normalized field amplitudes (power) are calculated in a wide range of variation of the controlling parameters, which are characteristic for distributed relativistic electron-waved self-vibrational systems: electric length of an interaction space N, bifurcation parameter proportional to (current I) Pirse one J and relativistic factor g. The nonlinear analysis methods include advanced versions of the correlation integral and multifractal analysis, algorithms of average mutual information, false nearest neighbors, Lyapunov's exponents and Kolmogorov's energy analysis, non-linear prediction schemes, spectral methods etc (in [1-3]). The dynamical and topological invariants of the RBWT dynamics in auto-modulation(AUM)/chaotic regimes are computed. There are constructed the bifurcation diagrams with definition of the dynamics self-modulation/chaotic areas in planes, namely, "J-g", "D-J". References: [1] Glushkov A.V., Methods of a Chaos Theory. Odessa: Astroprint, 2012. [2] Glushkov A.V., Khetselius O.Yu., Svinarenko A.A., Buyadzhi V.V., Methods of computational mathematics and mathematical physics, P.1. Odessa: TEC, 2015. [3] Prepelitsa G., Buyadzhi V., Ternovsky V., Photoelectronics. 22, 103-107 (2013).

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