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Complex dynamics in Hamiltonian-driven dissipative system

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We study the discrete system that approximates a billiard with oscillating boundaries. It consists of a dissipative 2D map affected by a conservative 2D map. We show that the variety of dynamic regimes including strange non-chaotic exist in this system as well as the multistability with the extreme number of coexisting attractors.

On an approximate formula for functionals with respect to stochastic Poisson measure

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The report proposes a formula for the approximate calculation of mathematical expectations of functionals with respect to a stochastic Poisson measure. The formula belongs to weak methods of approximating the values of functionals and is exact for third-order moments. Examples of application of the formula are given.

Optimizing 3D Ionosphere Reconstruction Algorithm Based on Modified Landweber Method for Enhanced Radiotomography Accuracy

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The report addresses the problem of three-dimensional ionospheric reconstruction using data from global navigation satellite systems. We present a novel algorithm for 3D ionospheric reconstruction based on a modified Landweber method. Key features include setting relaxation parameters and initial values according to the Chapman equation and exponential distribution, smoothness constraints using a nine-point finite-difference approximation of the second-order Laplace operator, and weighting coefficients to account for constraints and initial values. The algorithm structure and operating principle are described. We developed a mathematical modeling framework to investigate ionospheric reconstruction algorithms, utilizing simulated total electron content measurements derived from a realistic ionospheric model. Results show reconstruction quality dependencies on the choice of ionospheric pierce point and weighting coefficients determining smoothness constraints and initial approximations. A methodology for optimizing the 3D reconstruction algorithm parameters, utilizing an ionospheric mathematical model and surrogate multi-parameter optimization is proposed. This approach significantly reduces algorithm tuning time and ensures finding the global extremum. The proposed method advances ionospheric tomography capabilities with potential applications in radio communications, navigation, and space weather monitoring, demonstrating improved accuracy in reconstructing ionospheric electron density distributions.

Geometric Models of Nonwandering Indecomposable Continua

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Recently, I have researched and then announced the topological classification of the Birkhoff curves and the nonwandering continua possessing Wada property. At the same time, I made a fundamental mistake by allowing the existence of more than the only fixed point belonging to the Birkhoff curve.

Theorem 1 Birkhoff curve contains the only fixed point.
K. Kuratowski (1928) proved that an indecomposable continuum cutting a plane into
two regions turns out to be monostratic (monostratique) [1]. Therefore, the Birkhoff curve has the only fixed point with an index being equal to zero. It is simple. So that, the Birkhoff curve is consisted to be nonwandering indecomposable continuum turning out to be two invariant regions boundary with respect to dynamic system acting on the plane. The Birkhoff curve geometric model has been constructed based on the Knaster example indecomposable continuum having two composants [2]. Endpoints $(0,0)$ and $(0,1)$ of the Knaster's continuum are glued by the formula $(y-7/20)e^{2\pi x} \mapsto x+iy$.
Now, on the assumption of the principle of constructing the Birkhoff curve geometric model, geometric models of the nonwandering continua turning out to be three regions common boundary have been constructed. The continua turn out to be three regions common boundary. Moreover, these constructions turn out to be more adapted to dynamic systems.
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Dynamic holography for light fields transformation and materials diagnostics of advanced photonics and electronics

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The report presents a review of the theoretical and experimental studies in the field of dynamic holography, its history and the development stages are considered, new trends in its applications in science and engineering are indicated with the use of the obtained results. The classical holography aspects are treated along with the nonlinear-optical approach based on multiwave interaction schemes in the case when the third-order and higher-order nonlinearities are involved. Special attention is given to the use of dynamic holograms for the control of laser beams and for the real-time wave front transformation of light beams, singular including. The techniques to realize the topological charge inversion and multiplexing as well as the frequency transformation of images, showing much promise for 3D image visualization and for data coding when using the light-bean polarization and topological charge as information parameters, have been proposed. New schemes of contactless diagnostics for functional materials have been suggested on the basis of the dynamic grating method. The possibility to separate different nonlinearity mechanisms due to variations in the wave length of laser radiation and in the grating period is shown. The methods of measuring the parameters of bulk and thin-film semiconductors and also of the activated crystals (thermo-optical coefficient, thermal diffusivity, lifetime of the carriers, lifetime of the excited state, and so on) are considered.

A detailed study of the Bragg diffraction on the regular domain structures with inclined walls in 5%MgO:$LiNbO_3$ crystals

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Regular domain structures (RDS) in lithium niobate crystals provide nonlinear transformations of the spectral characteristics of laser radiation in the quasi-phase-matched regime as well as controlling thereof temporal, spatial and polarization parameters with high efficiency. The linear Bragg diffraction on RDS is the nondestructive method to study of their quality and parameters. We report the results of an experimental study and theoretical analysis of Bragg diffraction on RDS