Bistable regimes in quantum-dot mode-locked laser with optical injection

T. Habruseva, S. Hegarty, A. Vladimirov, A. Pimenov, D. Rachinskii,
E. Viktorov, G. Huyet
Centre for Advanced Photonics & Process Analysis, Cork Insitute of Technology, Cork, Ireland, e-mail: tatiana.gabruseva@gmail.com

We study experimentally the dynamics of quantum-dot passively mode-locked semiconductor laser under external optical injection. We show that the domains corresponding to different laser operation regimes have different boundaries depending on the sign of the master-slave detuning. The laser, therefore, demonstrates multiple bistabilities and hysteresis in the laser output parameters. The area of hysteresis loop grows with optical injection powers and disappears at sufficiently high injection levels.

Multistability and the transformation of tori in driven Ikeda map with weak dissipation

A.P. Kuznetsov, E.Yu. Latuhina, A.V. Savin
Department of Nonlinear Processes, Saratov State University, Saratov, Russia, e-mail: avsavin@rambler.ru

It is rather well known that a lot of attractors coexist in dynamical systems with weak dissipation. It seems to be interesting to consider the system with weak dissipation driven by signal which frequency is incommensurable with the eigenfrequency of the system. It is obvious that periodic attractors transform to quasiperiodical attractors, or tori, due to that influence. But one can expect some nontrivial effects, e.g. nonlocal bifurcations, in the case of a large number of coexisting attractors, for example, due to the increase of the attractor size. We consider the Ikeda map which is one of the classic models of nonlinear dynamics, driven by external signal and investigate the coexisting tori and their evolution in the case of weak dissipation.

Unidirectionally coupled generators of the hyperbolic chaos: phenomenon of generalized synchronization and based on it methods of the secure communication

O. Isaeva
Institute of Radio-Engineering and Electronics of RAS, Saratov State University, Saratov, Russia, e-mail: IsaevaO@rambler.ru

In 2005 by S.P. Kuznetsov the first example of physically realizable system with robust hyperbolic chaotic dynamics associated with Smale-Williams attractor was suggested [Phys. Rev Lett., 95, 144101]. In present work the direction of technical application of the generators of robust chaos is developed. These

systems seem to be useful for the known methods of secure or wide-band communication [A.S. Dmitriev, A.I. Panas. Dynamical chaos: new curriers of information for the communication systems. M.:Fizmatlit, 2002] based on the mixing of information signal with chaotic signal and detection of the information due to synchronization of transmitter and receiver, which are identical chaos generators. In present work it is shown, that in the case of robust chaotic transmitter and receiver the mechanism of information transition become more stable and the detection of information is possible even if transmitter and receiver are nonidentical.

The dynamics of coupled discrete maps with the conservative type of coupling at different dissipation values

A.P. Kuznetsov, A.V. Savin, D.V. Savin
Departament of Nonlinear Processes, Chernyshevsky Saratov State University, Saratov, Russia, e-mail: savin.dmitry.v@gmail.com

The dynamics of two coupled discrete maps is considered. The type of coupling is chosen in order not to introduce any additional dissipation in the system, so the dissipation level is determined only by the subsystem parameters. The decrease of dissipation leads to the complication of the parameter space structure and the picture of critical behaviour. Particularly, the line of transition to chaos via the Feigenbaum period-doubling cascade becomes divided into several fragments, the structure of the parameter space between them is rather interesting. Different mechanisms of this process are described.

Stability of periodic solutions of singular perturbed Stuart-Landau equation

A. Kashchenko
Yaroslavl State University, Yaroslavl, Russia, e-mail: sa-ahr@yandex.ru

It is considered singular perturbed Stuart-Landau equation

$$\varepsilon\dot{u} = (1+(-1+ic)|u|^2)u + \gamma e^{i\phi}(u(t-1)-u).$$

Here ε is small positive parameter ($0<\varepsilon\ll 1$). We study existence and stability of periodic solutions

$$u_{R,\Lambda} = R\exp(i\Lambda t)$$

of given equation. Here R,Λ are real constants and $R>0$. Let $L(c,\gamma,\varphi)$ be set of points (ω,ρ^2) those belong to ellipse

$$(\rho^2-1+\gamma\cos\varphi)^2+(\omega-c\rho^2+\gamma\sin\varphi)^2=\gamma^2$$

and to half plane $\rho^2>0$.