



EDITORIAL

On July 12–16, 2010 an international conference on *Nonlinear Dynamics and Complexity: Theory, Methods and Applications* was organized in Thessaloniki, Greece, dedicated to the 60th birthday of Professor Tassos Bountis. As a follow-up, a first special issue of IJBC containing papers based on topics presented at this conference was published in August 2011 (Volume: 21, Issue: 8). Due to the large number of contributions, not all of them were included in that volume. The present issue contains the remaining papers and it starts with a review paper by Patsis studying the dynamical mechanisms that support observed morphological features in barred-spiral galaxies, like the spiral arms that emerge out of the ends of the bar, as well as also the shape of the bar itself. The author finds realistic models where bars are built by stars mainly on regular orbits, while the stars on spirals evolve chaotically. However, he also encounters cases, where a major part of trajectories of the stars even in the bar are chaotic as well. Additionally, he examines the gas dynamics of barred-spiral systems, and finds that the presence of gas reinforces the intensity of the “chaotic” spiral arms. A second review paper by Tsallis, deals with some interesting points that are currently open in nonextensive statistical mechanics. Their analytical, numerical, experimental or observational aspects are discussed.

Further aspects of statistical mechanics are considered in the subsequent five papers by Gilbert and Sanders, de Oliveira and Robnik, Ruiz *et al.*, Karakatsanis *et al.* and Basios. In the first paper, the authors describe conditions under which higher-dimensional billiard models in bounded, convex regions are fully chaotic, generalizing the Bunimovich stadium to dimensions above two. de Oliveira and Robnik deal with scaling invariance in a time-dependent elliptical billiard. Ruiz *et al.* study chaotic orbits of conservative low-dimensional maps and present numerical results showing that the probability density functions of the sum of N iterates in the large N limit exhibit very interesting time-evolving statistics. Karakatsanis *et al.* study the coexistence of self-organized criticality and low-dimensional chaos at solar activity with results obtained by using the intermittent turbulence theory, the nonextensive q -statistics of Tsallis, as well as the singular value decomposition analysis. Basios addresses the problem of crystallization in nanophase materials, where recent evidence points to the presence of nonstandard kinetic and structural effects at the origin of unexpected self-organization phenomena. He provides a survey of the underlying mechanisms and of potential applications.

Fokas and Yang address a novel class of integrable ordinary differential equations (ODEs). By employing the concept of conjugate Hamiltonian systems and by using the fact that the classical Painlevé equations are Hamiltonian systems, it is straightforward to associate with each Painlevé equation two new integrable ODEs. Sophocleous and Leach examine some of the properties related to symmetries and singularities of the nonlinear evolution appearing in thin films related problems. The quantum Nambu Mechanics is addressed by Floratos. Delis *et al.* investigate the phenomenon of the diffraction of charged particles by thin material targets using the method of de Broglie–Bohm quantum trajectories.

The following five papers by Faranda *et al.*, Gerlach *et al.*, Sala *et al.*, Manos *et al.* and Boreux *et al.* deal with advanced numerical methods in nonlinear Hamiltonian dynamics.

Yang *et al.* study the emergence and evolution of cooperation on complex networks, by using the approach of evolutionary games. The theory of bivariate fractal interpolation surfaces constructed as attractors of iterated function systems, as well as applications of such surfaces to computer graphics and image processing are presented by Dracopoulos and Manousopoulos. Andreadis and Karakasidis deal with the structural stability of the Julia sets of noise-perturbed complex quadratic maps in the presence of dynamic and output noise both for the additive and the multiplicative cases.

The following six papers of the issue focus on time series analysis and their applications. In particular, Papanas *et al.* study the detection of direct causal effects and application in the analysis of electroencephalograms from patients with epilepsy, while Tsoutsouras *et al.* use cellular automata to simulate the brain activity in healthy and epileptic states. Kalimeri *et al.* deal with entropy analysis of word-length series of natural language texts. Iliopoulos *et al.* deal with issues of chaos, self-organized criticality, intermittent turbulence and nonextensivity of the seismic activity in the north area of the Aegean sea. Zhang *et al.* address the connectivity mapping of human brain evaluated by phase based evolution map approach. De Sanctis and Di Battista focus on the functional analysis for parametric families of functional data.

We are indebted to Professors Chua and Chen, chief editors of the *International Journal of Bifurcation and Chaos*, for agreeing to host the articles originating from the 2010 conference as special issues of the journal. Financial support from the CAMTP, University of Maribor, the National Research Center “Demokritos”, the National Program of Controlled Thermonuclear Fusion, the Institute of Communication and Computer Systems, and the Greek Public Power Corporation is also gratefully acknowledged.

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April 2012