Complexity

Special Issue on
Fractal-Type Dynamical Behaviors of Complex Systems

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CALL FOR PAPERS

Today, the development and advances in knowledge of nonlinear dynamical systems and processes as well as their collective effects allow us to include some typical complex phenomena that take place in nature, from nanoscale to galactic scale, in a unitary fashion of comprehension. From this perspective, complexity is a challenging notion for theoretical modeling, technical analysis, and numerical simulation, in physics and mathematics, among others, because highly correlated nonlinear phenomena evolving over a large range of timescales and length-scales control the underlying systems and processes scaling in their spatiotemporal evolution. In fact, a common view and congruence provide the understanding that complexity and chaos alike are the sensible philosophical assumptions allowing systems composed of many firmly demarcated subareas to be integrated thereby generating coherent and quasi-predictable behaviors at the limit of their evolution.

Indeed, the available physical, biological, financial data, and technological (mechanical or electronic devices) complex systems can be managed from the same conceptual approach, both analytically and through computer simulation, using the effective nonlinear dynamics methods. To explain economic growth, in the extensive area of complexity economics, some predictive tools have been developed. Original papers relating to a certain objective presented above are especially welcome by this special issue.

As a typical example, plasma is a strongly nonlinear dynamic system, with many degrees of freedom, favorable for the development of ordered structures, instabilities, and transitions from ordered to chaotic states, and vice versa. To name a few more, the complex space charge structures such as fireballs, multiple double layers, plasma bubbles, solitons, or laser ablation plumes are just some common ones. They are recommended for further investigation in this special issue of research papers.

Fractals provide a fascinating subject for study, which are not necessarily in physical forms, but can be any type of infinitely scaled and repeated patterns, spatial patterns, or temporal patterns, together or respectively. Easy to notice, the fractal analysis has become an effective method in experimental practice, which applies nontraditional mathematics to analyzing patterns that exceed the comprehension horizon of traditional Euclidean metrics and measures. From a useful quantitative point of view, for instance, the concept of fractal dimension offers the ability to describe and characterize the complexity of images or more precisely their texture composition, in materials science, plant biology, and medicine. Also, the identification of new purely mathematical fractals and multifractals, in any scientific branch, has become a current legitimate activity. In this line, the surface topography quantification, phase space embedding techniques and various attractors reconstruction, applications in nuclear energy and environmental sciences, and drug delivery of pharmaceutical compounds in the living animals body are subjects worthy of exploitation.

Potential topics include but are not limited to the following:

- Chaotic instabilities scenarios in mathematical physics theory of complexity
- Fractal type of spatiotemporal behaviors in the field theory
- Nonlinear dynamic processes in plasma complex structures and laser ablation
- Fractal analysis of fracture surfaces in materials testing
- Nonlinear dynamics in biological complex systems
- Diagnosis of complexity in extensive financial data by time-series method
- Complex phenomena modeling and pattern predictions in environmental sciences
- Computer simulation of nonlinear dynamics for drug delivery in the human body
- Structure models that contain reoccurring patterns in nuclear physics and medicine

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