Advances in Mathematical Physics

Hindawi

Special Issue on

Theoretical and Computational Advances in Nonlinear Dynamical Systems

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The theory of dynamical systems is the paradigm for studying various scientific phenomena, ranging from complex atomic lattices to planetary motion, from water waves to weather systems, from chemical reaction to biological behaviors, and so forth. Application of dynamical systems has widely arisen in the multidisciplinary fields including mathematics, physics, chemistry, biology, and even economy and sociology.

In recent years, due to rapid development of theoretical and computational techniques, the nonlinear dynamical systems have attracted increasing volume of interest, where nonlinearity plays the heart role of many interesting dynamical behaviors. A typical research area is the spatial and temporary evolution of the localized structures for various nonlinear dynamical systems, such as solitons and vortices. Motion of these localized structures, as well as their interactions, reflects the triggering features for the nonlinear dynamical systems, being discussed in the condensed matter physics, fluidic media, solid lattices, and many relevant areas. Meanwhile, the mathematical tools, including the analytical and numerical aspects, have been developed in dealing with the nonlinear dynamical systems qualitatively and quantitatively.

Complexity of the nonlinear dynamical systems can be further revealed when chaotic and stochastic behaviors are considered. For instance, interactions between nonlinearity and randomness are highlight topics nowadays, emerging from soliton dynamics in random media to destruction of the Anderson localization by nonlinearity. Thanks to the rapid development of computer resources, these complex phenomena for the nonlinear dynamical systems can be simulated and studied in relevant scientific communities.

Potential topics include but are not limited to the following:

- Nonlinear dynamics of continuous, discrete, and hybrid systems
- Integral equations and applications
- Symmetry and conservation laws for nonlinear PDEs
- Solitons and vortices and their interactions
- Chaos, resonances, and stability analysis in nonlinear systems
- Interplay of nonlinearity and randomness for dynamical systems
- Symbolic and numerical methods
- Fluid dynamics, nonlinear optics, and Bose-Einstein condensates

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