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Editorial

Nonlinear Systems: Dynamics, Control, Optimization and Applications to the Science and Engineering

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Nonlinear phenomena frequently occur in many fields, such as physics, biology, and engineering. The mathematical models of nonlinear factors are complicated for theoretical and numerical analysis due to the underlying evolution over a large range of time scales and length scales. With the rapid development of advanced nonlinear dynamics methods, numerous physical, biological, or technologically complex systems and stochastic systems, such as mechanical or electronic devices, can be managed through nonlinear dynamics methods, both analytically and through computer simulation.

This Special Issue aimed to highlight the newest results on the dynamics, control, optimization, and applications of nonlinear systems. Several advanced nonlinear dynamics and numerical methods were covered in this Special Issue.

The Special Issue contains more than ten successful invited submissions [1–14], which are highly related to the potential topics. In [1], new stability criteria based on the Razumikhin technique were developed for impulsive switched delay systems subject to stochastic disturbances. In particular, the delay in the studied system was assumed to be a Markov chain rather than a deterministic delay. An optimal timing fault tolerant control algorithm was presented in [2] for switched stochastic systems with switched drift faults. In [3], the existence and stability of equilibrium points for quantized Hill systems were studied. By dividing three different cases that provide all possible locations, the locations of the equilibrium points were analyzed. For a class of discrete weakly nonlinear state-dependent coefficient control systems, [4] investigated the asymptotic solution of the initial singularly perturbed control problem for the matrix discrete Riccati equation with coefficients weakly dependent on the state and proposed a one-point PA regulator. In [5], the study of finite-time passivity analysis for neural-type neural networks was investigated. Applications of the fixed-time control approach to flexible spacecraft and third-order sliding mode control to single-rotor wind turbines were addressed in [6,7].

The nonlinear dynamics in ecological and biological complex systems are also of high interest in this Special Issue. In [8], the global stability of a delayed ecosystem, namely, a delayed feedback Gilpin–Ayala competition model with impulsive disturbance, was reported. In [9,10], several kinds of nonlinear dynamics problems in biological systems (such as epidemic systems with delayed impulse and delayed virus dynamic models) were studied. The topic of the optimization methods of complex systems is also included in this Special Issue. An adaptive evolutionary computation algorithm was proposed in [11] to overcome the overparameterization issue in traditional evolutionary and swarm computing paradigms. A new iterative method for finding extreme equations based on the maximum principle was developed for quantum systems in [12]. Two published works [13,14] focused on the applications of optimization methods in complex engineering systems.

The range of topics addressed in the current issue is not exhaustive. Further research on the dynamics, control, optimization, and applications of nonlinear systems is needed. We hope that some new insights into nonlinear systems are provided in this Special Issue.

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We would like to end this preface by thanking all of the reviewers and editors that helped us in the completion of this Special Issue.

The response to our call had the following statistics:

Submissions (36);

Publications (14);

Rejections (22);

Article types: Research Article (14);

We found the edition and selections of papers for this Special Issue very inspiring and rewarding. We also thank the editorial staff and reviewers for their efforts and help during the process.

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