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Editorial

Special Issue: Lyapunov methods and engineering applications in delay systems

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This Special Issue is devoted to the progress in the application of the Lyapunov methods in the study of different classes of systems and models. Lyapunov techniques are proved to be very successful and have given decisive impetus to the modern development of the qualitative theory (stability, boundedness, almost periodicity, asymptotic properties) of different classes of differential, integral, functional-differential, impulsive, fractional equations. A manifest advantage of this method is that it does not require the knowledge of solutions and therefore has great power in applications. Various modifications of the classical Lyapunov methods are widely used in many fields of science and engineering. Examples include Lyapunov-Krasovskii functional methods, Lyapunov-Razumikhin function methods, piecewise-continuous Lyapunov function methods, fractional Lyapunov function methods and others.

On the other hand, the behavior of many real word phenomena depends on their history and some memory effects. The dynamics of delayed systems has long been and will continue to be one of the dominant themes due to its theoretical and practical significance.

There have been increasing research activities in the application of Lyapunov strategies and delays in control theory. The design of efficient controllers has attracted the attention of a wide audience of researchers.

We invited investigators to contribute original research articles as well as review articles focused on the latest achievements in Lyapunov methods and their applications in systems with delays and controllers' design. Both theoretical and application results have been submitted. This issue contains 13

fascinating papers focusing on the Lyapunov method and its extensions, as well as on their applications to the stability theory, synchronization, control strategies and more.

The paper authored by J. Gong, Y. Zhao, J. Cao and W. Huang proposes a distributed collision-free control scheme for connected and automated vehicles at a non-signalized intersection. The Pontryagin Minimum Principle and phase-plane method are applied to find the optimal control sequences. Two manuscripts authored by A. Martynyuk, G. Stamov, I. Stamova and Y. Martynyuk–Chernienko deal with a new regularization scheme for a family of uncertain fuzzy systems of differential equations with respect to the uncertain parameters. Important fundamental properties of the solutions are discussed on the basis of the established technique and new results are proposed. Also, for a regularized fuzzy system, a generalization of the direct Lyapunov method is adapted on the base of matrix-valued Lyapunov-like functions. The issues of exponential projective synchronization and adaptive exponential projective synchronization are addressed in the paper of J. Guo, Y. Shi, W. Luo, Y. Cheng and S. Wang and are analyzed for quaternion-valued memristor-based neural networks with time delays. Different proper control schemes are designed and several criteria for ascertaining exponential projective synchronization and adaptive exponential projective synchronization are derived based on Lyapunov theory and the properties of sign function. The problem of observer-based memory state feedback control design for semi-Markovian jump systems subject to input delays and external disturbances, where the measurement output was vulnerable to randomly occurring cyber attacks is explored by R. Sakthivel, P. Selvaraj, Oh-Min Kwon, Seong-Gon Choi and R. Sakthivel. By using the Lyapunov stability theory, an extended Wirtinger's integral inequality and stochastic analysis, a stability criterion was proposed in the form of linear matrix inequalities. The paper authored by Z. Hajjej focuses on a nonlinear Cauchy problem aimed to describe the deformation of the deck of either a footbridge or a suspension bridge in a rectangular domain. A novel event-triggered mechanism was developed by Z. Liu to determine when to impose control, alongside the development of the corresponding impulsive strategy for the production-warehousing-selling model. In the paper of B. Younes, A. Beniani, K. Zennir, Z. Hajjej and H. Zhang the global existence for a wave equation involving the fractional Laplacian with a logarithmic nonlinear source is investigated by using the Galerkin approximations. The impulsive synchronization of a class of nonlinear multiple neural networks with multi-delays was considered by C. Yi, J. Cai and R. Guo under a dynamic event-based mechanism. A power system frequency control strategy that integrates an observer-based event-triggered mechanism to defend against denial-of-service attacks and accommodates the integration of renewable energy sources is presented by X. Wang, Y. Bai, Z. Li, W. Zhao and S. Ding. The prescribed-time tracking control for single-input single-output nonlinear systems with uncertainties is studied by L. Feng, C. Zhang, M. Abdel-Aty, J. Cao and F. E. Alsaadi. The paper authored by C. Messikh, S. Labidi, A. Bchatnia and F. Mtiri examines a porous-elastic system with a fractional operator incorporated in the memory term, which acts exclusively on one equation within the system. Finally, K. Vijayaraghavan developed an observer design for a matrix-Lipchitz nonlinear system with measurement delay using time-averaged Lyapunov stability criterion.

The guest editors expected that all the manuscripts published in this issue will enrich the readers knowledge and stimulate researchers to extend, generalize, and apply the proposed results.

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