Unmanned Systems, Vol. 14, No. 3 (2026) 545–547

DOI: 10.1142/S2301385026020012

UNMANNED SYSTEMS
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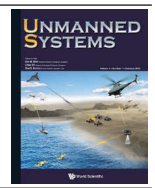

Editorial: A Special Issue in Honor of the 60th Birthday of Professor Zhong-Ping Jiang

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We are delighted to organize this special issue in celebration of the 60th birthday of our colleague and friend Professor Zhong-Ping Jiang of New York University, USA.

Professor Jiang is widely recognized for his contributions to the stability and control of interconnected nonlinear systems and as a key contributor to nonlinear small-gain theory. His recent research contributions have spanned a wide range of topics, including robust adaptive dynamic programming, learning-based optimal control, nonlinear control, distributed control and optimization, and their applications to computational and systems neuroscience, connected transportation, and cyber-physical-human systems.

Professor Jiang currently serves as Deputy Editor-in-Chief of the *IEEE/CAA Journal of Automatica Sinica*. Previously, he has also served as Senior Editor for *IEEE Control Systems Letters (L-CSS)*, *Systems & Control Letters*, and *Journal of Decision and Control*. In addition, he has held roles as Subject Editor, Associate Editor, and Guest Editor for several journals, including *International Journal of Robust and Nonlinear Control*, *Mathematics of Control, Signals and Systems*, *IEEE Transactions on Automatic Control*, *European Journal of Control*, and *Science China: Information Sciences*.

Professor Jiang has been well-recognized for his research and professional service contributions. Among his many notable accolades are his election as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), International Federation of Automatic Control (IFAC), Asia-Pacific Artificial Intelligence Association (AAIA), and the American Association for the Advancement of Science (AAAS) and a foreign member of the Academia Europaea.

On this special occasion of celebrating Professor Jiang's 60th birthday, we are organizing this special issue. This special issue collects 12 papers from Professor Jiang's former students, collaborators and friends. A brief introduction to these 12 papers is given below.

The paper by Lei, Chen and Chen [1] on accurate perception of large-scale ocean environment fields overcomes the challenge of direct observation severely limited by the sparse, asynchronous, and resource-constrained measurements with mobile platforms such as underwater gliders and robots by proposing a large-scale ocean environment perception framework that directly addresses the constraints of underwater robots operating with sparse and limited measurements. This framework integrates three components: Spatiotemporal decomposition to obtain compact and interpretable ocean features; multi-objective sparse sampling that jointly optimizes information gain, spatial coverage, and depth anchors; and spatiotemporal fusion to reconstruct full fields from sparse *in-situ* data.

The paper by Zhou, Sun and Feng [2] on fixed-time group formation tracking (FXGFT) for heterogeneous multi-agent systems under a directed interaction graph designs a novel fixed-time distributed observer to estimate the leader's state in each subgroup under the directed graph, based on which FXGFT controllers are developed for each follower to achieve the desired time-varying formation while following the trajectory of their respective leader.

Using the cart-pole system, a classical benchmark in control engineering, characterized by instability, nonlinearity, underactuation, and nonminimum phase properties, the article by Chen, Liu and Fu [3] reports on a comparative evaluation of two distinct control paradigms: a model-based strategy that employs an initial phase of friction compensation and parameter identification, followed by the application of an improved energy-based method and LQR stabilization, and a reinforcement learning approach utilizing the Deep Deterministic Policy Gradient algorithm in conjunction with sim-to-real transfer techniques.

The work by Hong *et al*. [4] addresses the problem of multiple unmanned aerial vehicles task planning for post-disaster supply delivery, a problem that comprises two coupled multi-objective optimization problems: task allocation and path planning. To tackle this complex problem, the authors build a hierarchical framework and propose a decoupling algorithm that leverages deep learning for feature

extraction and optimization techniques for precision search, thereby ensuring the solution's efficiency.

The eigenvalue/eigenvector of matrices plays a fundamental role in matrix theory and has many applications. In unmanned systems ranging from single-vehicle autonomous navigation to multi-agent swarm coordination, eigenvalue/eigenvector analysis provides the geometric foundation for state-space dynamics. To reveal the geometric meaning of eigenvalue/eigenvector, Cheng and Qi in their paper [5] establish three properties the universal eigenvalues/eigenvectors of hypermatrices: (1) The eigenvalue/eigenvector of Kronecker product of hypermatrices is the product of eigenvalues/eigenvectors of factor hypermatrices; (2) The similarity of hypermatrices ensures the same eigenvalues/eigenvectors; and (3) The Cayley-Hamilton Theorems of Hypermatrix.

The work by Qin and Liu [6] on event-triggered feedback optimization for uncertain nonlinear systems addresses the event-triggered feedback optimization problem for a class of nonlinear systems in strict-feedback form with dynamic uncertainties. By employing backstepping and gain assignment techniques, the authors develop two event-triggered mechanisms and a feedback optimization protocol that constructs the closed-loop system as a feedback interconnection of multiple input-to-state stable subsystems. The small-gain theorem is applied to guarantee closed-loop stability, ensuring that the proposed protocol drives the system output to the optimal solution while excluding the Zeno behavior.

Hybrid aerial-ground robots have recently attracted increasing attention for their versatile mobility and adaptability across complex environments. The manuscript by Zhou *et al*. [7] presents a bias-aware estimation and control framework for a miniaturized dual-tilt aerial-ground robot. More specifically, it adopts a bias-aware model that captures servo bias as a matched term in a reduced-order model, allowing certainty equivalent compensation through the allocation map. A fixed-time bias observer is designed to recover installation angle errors from closed-loop signals within a prescribed time window, furnishing reliable parameter estimation even during transients. Furthermore, an integral terminal sliding-mode controller with a saturation-robust channel is developed to guarantee finite-time reaching and terminal tracking, while preserving boundedness under estimator transients and actuator input constraints.

Existing results on the leader-following consensus problem for multiple uncertain rigid body systems with an uncertain leader are limited to acyclic switching networks and require full availability of the leader's angular velocity states. The paper by Peng and Huang [8] leverages an adaptive distributed observer for the uncertain leader system and solves the leader-following consensus problem for multiple rigid body systems with an uncertain leader over jointly connected switching networks, which may be disconnected at any instant. Furthermore, the proposed control law depends only on the output of the leader system for the angular velocity and is robust to bounded external disturbances with unknown bounds.

The paper by Yang *et al*. [9] considers the stability of maternal hemodynamic systems in obstetric anesthesia, which is crucial for the safety of both maternal and fetal well-being. The traditional method for maintaining this stability by manually infusing phenylephrine to patients during surgery may lead to insufficient precision in the dosage. In this paper, based on auto-regressive with exogenous input models, the authors develop an output-feedback optimal controller that integrates a state reconstruction technique and an optimal state-feedback control policy. The proposed method effectively compensates for hypotension induced by bupivacaine through precise infusion of phenylephrine.

The paper by Chen, Gao and Tan [10] presents a discrete-time extremum seeking control (ESC) scheme for multi-input single-output Hammerstein systems with unknown linear dynamics and a multi-input multi-output cost function. Inspired by stochastic approximation with expanding truncations, the authors propose an ESC algorithm, which injects stochastic perturbations into the inputs to systematically explore the high-dimensional input space while ensuring bounded iterates and maintaining closed-loop stability. This algorithm guarantees convergence to the stationary points of the composite multi-input, multi-output cost function.

The work by Wu, Li and Lin [11] on data-driven event-triggered control addresses the conservatism of conventional isotropic triggering conditions. The authors propose a topology-aware data-driven event-triggered control framework. By extracting the intrinsic Lyapunov matrix and the dissipative dynamics directly from offline data, the proposed framework effectively "shapes" the triggering manifold, ensuring that it aligns seamlessly with the natural physical characteristics of the plant rather than imposing an arbitrary spherical constraint. An optimization-based synthesis is formulated to maximize the safety region while strictly guaranteeing global exponential stability and a strictly positive minimum inter-event time.

Hybrid systems, dynamical models that integrate the dynamics of continuous-time systems and those of discrete-time systems, appear in many engineering fields. While many control problems regarding hybrid systems have been solved, model reduction is among the problems that remain open. The paper by Niu, Scarciotti and Astolfi [12] addresses the model reduction problem for linear hybrid systems via the interconnection-based technique called moment matching. The authors consider two classical interconnections, namely the direct and swapped interconnections, in the hybrid setting and present families of reduced-order models for each interconnection via a hybrid characterization of

the steady-state responses. They also explore the design of a reduced-order model that achieves moment matching simultaneously for both interconnections.

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Acknowledgments

We would like to take this opportunity to thank Ms. Amanda Yun, Senior Editor of World Scientific Publishing, for her indispensable guidance and support. We also wish to express our appreciation to all the authors and the reviewers who have made this special issue possible.

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