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EDITORIAL

IEEE ACCESS SPECIAL SECTION EDITORIAL: SPECIAL SECTION ON NEW DEVELOPMENTS ON RELIABLE CONTROL AND FILTERING OF COMPLEX NONLINEAR SYSTEMS

During the past three decades, the problems of reliable control and filtering have attracted considerable attention due to the growing demands for system safety, reliability, maintainability, and survivability. The main aim of reliable control and filtering is to design a suitable controller and filter with guaranteed stability and performance, respectively; not only when all the system components are in operation, but also when some component failures occur. To guarantee a higher reliability level and better control performance, reliable control systems depending on various control strategies have tried to achieve these critical requirements, i.e., the pole region assignment method, coprime factorization method, the algebraic Riccati equation (ARE)-based method, the Hamilton-Jacobi inequality (HJI)-based method, and linear matrix inequality (LMI)-based method. Although many researchers have investigated the reliable control/filtering problems for linear systems with different scenarios for many years, the topic of reliable control/filtering in complex nonlinear systems is still in the early stages of development and many critical issues remain to be further investigated.

The purpose of this Special Section in IEEE Access is to provide up-to-date research on technical innovations and theoretical advancement in system analysis and reliable controller/filter design of complex nonlinear systems. This Special Section contains 12 articles, and a brief overview of the articles included is provided as follows.

1) In the article "Interval non-probabilistic reliability of a surrounding jointed rockmass in underground engineering: a case study," Dong, *et al.*, proposed a new interval non-probabilistic reliability measurement and analysis method for a jointed rockmass in underground engineering based on the interval model and block theory. The proposed method requires knowledge of the bounds of the uncertain parameters but not their specific distributions. As a result, the initial data requirements are reduced considerably. The proposed interval non-probabilistic reliability method was used to evaluate the stability of the rockmass in the Jiaojia gold mine. The calculation results of the interval non-probabilistic reliability were found to be in agreement with an actual situation. It can be thus concluded that the interval non-probabilistic reliability method is applicable when the amount of data is scarce.

2) In the article "Solving multiple fleet airline disruption problems using a distributed-computation approach to integer programming," by Wu, *et al.*, a new modified Traveling Salesman Problem (TSP) model was formulated to generate feasible flight routes for producing a recovery plan for the airline disruption problems. A distributed computation network was constructed to solve the modified TSP model using Dang and Ye's method, and the feasible flight routes for all the aircrafts in all the fleet types can be generated simultaneously in the distributed computation. It has been shown by authors that with the proposed approach, not only the same solutions as those in literature can be computed, but also solutions that are better than those in literature can be found.

3) In the article "Sliding mode regulator for the perturbations attenuation in two tank plants," De Jesus Rubio, *et al.*, developed a useful sliding mode approach for solving the perturbations attenuation issue. The results showed that the sliding mode regulator achieves better perturbation attenuation compared with the geometric regulator. This work also represents the theoretical and application basis for developing the perturbations attenuation issues, for being able afterwards to perform an implementation in functioning plants.

4) The article "Model-based application of fuzzy control to a class of industrial process operation systems with uncertainty," by Wang, *et al.*, presented a new method based on fuzzy control model with uncertainty fulfilling the condition of sector bound for designing set-points compensation in industrial operation systems. The sufficient conditions ensuring the stability of the lower layer system were obtained. Under the fact that the dual-layer model works on different time scales in the device layer and the operation layer, an augmented system containing the uncertainties of systems was also introduced. The formulation of a quadratic optimization problem was designed and the S-Procedure was adopted to derive a fuzzy output feedback controller. The proposed method has been carried out in a flotation process.

5) The article "Adaptive control for nonaffine nonlinear systems using reliable neural network approximation," by Sun and Pan proposed a reliable self-structuring neural network (SSNN) approximation-based adaptive control for a class of uncertain non-affine nonlinear systems, where neurons were added according to the locations of the system states. It has been shown by authors that the proposed approach has the following advantages: i) the proposed SSNN is with allowable computational complexity and avoids the possible redundant problem; ii) the proposed control law is once-differentiable control; and iii) the stability analysis is fit for the whole control procedure. The effectiveness of the proposed control law was illustrated by the stability analysis in the whole tracking procedure and shown by the simulation results.

6) In the article "Robust adaptive tracking control for manipulators based on a TSK fuzzy cerebellar model articulation controller," by Guan, *et al.*, a robust adaptive Takagi-Sugeno-Kang (TSK) fuzzy cerebellar model articulation control (FCMAC) strategy was presented and has been effectively used to solve inherent performance problems associated with manipulator tracking control. The proposed control system consists of an adaptive FCMAC and a robust compensator. The FCMAC was applied as the main tracking controller, while the robust compensator was designed to mitigate the effects of approximation errors. It has been shown by simulation results that the proposed intelligent adaptive control scheme can ensure a good tracking performance.

7) Diagnosability is a key factor in the analysis of reliability for a network system. In the article "Structural properties and t/s-diagnosis for star networks based on the PMC model," Liang, *et al.* derived some new properties for a star network and introduced a sufficient condition to judge that an n-dimensional star graph is diagnosable. The authors also proposed a t/s-diagnosis algorithm to locate a set of vertices containing all faulty vertices with size of none exceeding s.

8) In the article "Design and experimental testing of a free-running ship motion control platform," by Zheng, *et al.*, a merchant container ship motion control platform in which the platform motion can be controlled by the rudder and propeller was presented. The platform can monitor the ship attitude and apply different ship motion control algorithms on the rudder and propeller. The ship motion control algorithm validation can also be easily achieved due to the platform design. The authors also introduced the working principle of the ship motion control platform and selected the ship motion response model. Free-running experiments and simulation tests were conducted to demonstrate the maneuverability and fail-safety of the platform.

9) In the article "Finite-time trajectory tracking fault-tolerant control for surface vessel based on time-varying sliding mode," by Fu, *et al.*, a solution to the problem of trajectory tracking for a surface vessel was proposed and evaluated. A sliding mode control-based tracking control method was proposed with the capability of finite-time convergence with zero tracking errors, in the presence of parametric uncertainties, external disturbances, and thruster faults. Moreover, it has been shown that the convergence time of the errors as an explicit parameter can be assigned by the user/designer according to mission requirements.

10) In the article "Robust adaptive neural prescribed performance control for MDF continuous hot pressing system with input saturation," by Zhu, *et al.*, a prescribed performance-based robust adaptive control scheme was developed for a medium-density fiberboard (MDF) continuous, hot pressing electro-hydraulic servo system (EHSS). It has been shown that the proposed approach was able to achieve a high accuracy control performance in the presence of input saturation and unknown external disturbances. With application of a new error transformation function, the tracking error can be converged in the established small neighborhood. By introducing a well-defined smooth function and using a Nussbaum function, the nonlinear term arising from the input saturation was compensated. As assumptions on the boundedness of the uncertain parameters and external disturbance are not required, the robustness of the proposed controller can be significantly enhanced.

11) The article, "Tracking synchronization for DC microgrid with multiple-photovoltaic arrays: an event-based fuzzy control Scheme," by Zhong, studied the event-based distributed fuzzy control problem for DC microgrids with dc/dc converters. Based on a Lyapunov function with the help of Wirtinger inequality, and combined with some convexification approaches of matrix inequality, some results on designing the event-based distributed controller were derived in terms of linear matrix inequalities. It has been shown that the desired controller uses fewer communication resources to guarantee stabilization of the DC microgrid and voltage tracking synchronization performance.

12) Finally, in the article "Stabilization of discrete-time systems via a partially disabled controller experiencing forced dwell times," Li and Wang studied the stabilization problem of discrete-time systems via applying a partially disabled controller, where the partial action of the desired controller was illustrated by a stochastic variable. The existence conditions for the partially disabled controller have been given in terms of linear matrix inequalities. Simulation studies have been given to demonstrate the utility of the proposed methods.

We believe that this Special Section will provide future research directions for researchers and practitioners to reliable control/filtering theories and applications. As the guest editors of this Special Section, we would like to thank all the authors for contributing high-quality articles. We would also like to express our deepest gratitude to all the anonymous reviewers for their time and efforts spent reviewing and providing constructive comments to improve the quality of the articles. Finally, we appreciate the former IEEE ACCESS Editor-in-Chief, Professor Michael Pecht and other staff members of IEEE ACCESS, for their great support of our Special Section.

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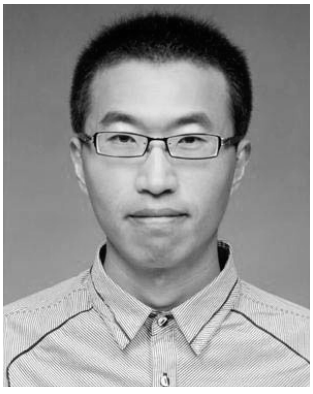

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