Hindawi
Mathematical Problems in Engineering
Article ID 1819540

Editorial

Advanced Control for Singular Systems with Applications

Wanquan Liu,[1] Xinggang Yan,[2] Shoudong Huang,[3] Chunyu Yang,[4] and Guoliang Wang[5]

[1]*Curtin University, Perth, WA, Australia*
[2]*University of Kent, Canterbury, UK*
[3]*University of Technology Sydney, Sydney, NSW, Australia*
[4]*China University of Mining and Technology, Xuzhou, China*
[5]*Liaoning Shihua University, Fushun, China*

Correspondence should be addressed to Wanquan Liu; wanquan@cs.curtin.edu.au

Received 7 February 2018; Accepted 11 February 2018

1. Introduction

Singular systems, also referred to as descriptor systems, semistate systems, differential-algebraic systems, or generalized state-space systems, have been one of the main research topics in control theory for nearly half a century as such systems have broad applications in different areas, for example, in the Leontief dynamic model, electrical systems, and mechanical systems.

Many classical control theories and new concepts have been developed for singular systems in the last twenty years such as controllability, impulsive control, and optimal control. In recent years, with the development of communication systems, computer network, and biological systems, some new trends in optimization and control theory for singular systems have emerged and evolved [1–4], which motivated this special issue.

Control systems are developing fast with the advancement of new technologies as well as new systems such as network control, biological systems, and quantum control systems. As we know singular systems can be used to model dynamic systems in a more general framework and more attention should be paid to the development of singular systems with currently occurring applications. Recently, notable advances in biological systems, communication systems, and computer network have increasingly promoted some important new directions in the study of singular systems.

This special issue is intended to present and discuss the new development in singular systems and their applications in different engineering areas. The focuses of this special issue are on the analysis and control of singularly perturbed systems, robust control of singular systems, stability analysis of nonlinear singular systems, singular Markovian systems, and applications of singular systems.

2. The Special Issue

For this special issue, we solicited high quality, original research articles on singular system, theory, and applications. There are 28 submissions in total, and 14 of them are published after a fair and rigorous review process organized by the guest editorial team with the help of the journal editorial office. The accepted papers are more oriented on the robust control of singular systems and the applications of singular systems.

Seven accepted papers are on robust estimation and robust control of singular systems. The paper by Y. Feng et al. investigated the problem of H^∞ filtering for a class of discrete-time Lipschitz nonlinear singular systems with measurement quantization. Y. Wang et al. presented their work on the dynamic output-feedback H^∞ tracking control for fuzzy networked systems, in which each system is discrete-time nonlinear and missing measurable data. The paper by Y. Wang et al. considered the robust H^∞ fault detection for networked Markov jump systems with random time-delay. The random time-delay is modeled as a Markov process, and the networked Markov jump systems are modeled as

control systems containing two Markov chains. The delay-dependent fault detection filter is constructed. Q. Wang et al. presented their work on the design of fuzzy controller with guaranteed H^{∞} performance for a class of the Takagi-Sugeno fuzzy singularly perturbed switched systems. The paper by W. Yan et al. designed a fault detection and estimation algorithm for the robust fault detection and estimation in nonlinear systems with unknown inputs and unknown constant time-delays. G. Wang and Z. Li presented their work on the stabilization of continuous-time random switching systems via exploiting a fault-tolerant controller, where the dwell time of each subsystem consists of a fixed part and random part. In the paper by G. Wang and H. Cai, a general stabilization problem of stochastic delay systems is realized by a disordered controller and studied by exploiting the disorder-dependent approach.

Seven accepted papers are on the different applications of singular systems. J. Liu et al. proposed a singular system model of the aphid ecosystems by considering the change of the parameter related to the natural enemy population and the impact on the aphid populations in the fold catastrophe manifold. They also performed qualitative analysis and control of the singular system model of aphid ecosystems. Q. Zhao and A. Wang considered the problem of optimization of multiresonant wireless power transfer network based on generalized coupled matrix. Z. Wang et al. considered the problem of tension control in a two-motor winding system; a sensorless tension control method with PI parameters of speed controllers adaptive is proposed. H. Chen et al. considered the application of sensor fault estimation in the inverter of high-speed railway. They proposed a data-driven incipient sensor fault estimation methodology under multivariate statistics frame, which incorporates the Kullback–Leibler divergence in information domain and neural network approximation in machine learning. Y. Ding and Q. Liu proposed a data-driven fault diagnosis method which combines the Kriging model and neural network with applications to power transformers. W. Chen et al. presented an automated tool trajectory planning of spray painting robot for complex curved surface based on exponential mean Bézier method. Finally, S. Liu et al. applied a singular perturbation approach to the robust course keeping control of a fully submerged hydrofoil vessel. A two-time scale model is established so that the controllers of the fast and slow subsystems can be designed separately.

Although the selected topics and published papers may not represent all of the recent development in the area, the guest editorial team hope that readers find the special issue helpful and useful.

Acknowledgments

The guest editors of this special issue would like to thank all authors for their submitted papers as well as all reviewers for their hard work and detailed reviews, which led to the 14 accepted papers and the publication of the special issue.

Wanquan Liu
Xinggang Yan
Shoudong Huang
Chunyu Yang
Guoliang Wang

References

[1] Z. Feng and P. Shi, "Sliding mode control of singular stochastic Markov jump systems," *Institute of Electrical and Electronics Engineers Transactions on Automatic Control*, vol. 62, no. 8, pp. 4266–4273, 2017.

[2] M. Chadli and M. Darouach, "Further Enhancement on Robust H^{∞} Control Design for Discrete-Time Singular Systems," *Institute of Electrical and Electronics Engineers Transactions on Automatic Control*, vol. 59, no. 2, pp. 494–499, 2014.

[3] G. Wang, Q. Zhang, and X. Yan, "Analysis and design of singular Markovian jump systems," *Analysis and Design of Singular Markovian Jump Systems*, pp. 1–284, 2015.

[4] G. Zhang and W. Liu, "Impulsive mode elimination for descriptor systems by a structured P-D feedback," *Institute of Electrical and Electronics Engineers Transactions on Automatic Control*, vol. 56, no. 12, pp. 2968–2973, 2011.

Composition Comments

1. Please check and confirm the author(s) first and last names and their order which exist in the last page.

Author(s) Name(s)

It is very important to confirm the author(s) last and first names in order to be displayed correctly on our website as well as in the indexing databases:

Author 1
Given Names: Wanquan
Last Name: Liu

Author 2
Given Names: Xinggang
Last Name: Yan

Author 3
Given Names: Shoudong
Last Name: Huang

Author 4
Given Names: Chunyu
Last Name: Yang

Author 5
Given Names: Guoliang
Last Name: Wang

It is very important for each author to have a linked ORCID (Open Researcher and Contributor ID) account on MTS. ORCID aims to solve the name ambiguity problem in scholarly communications by creating a registry of persistent unique identifiers for individual researchers.

To register a linked ORCID account, please go to the Account Update page (http://mts.hindawi.com/update/) in our Manuscript Tracking System and after you have logged in click on the ORCID link at the top of the page. This link will take you to the ORCID website where you will be able to create an account for yourself. Once you have done so, your new ORCID will be saved in our Manuscript Tracking System automatically.