PREFACE

Special section on

New Perspectives in Nonlinear and Intelligent Control

In Honor of Alexander P. Kurdyukov

Nonlinear and intelligent control paradigms have dramatically changed the face of control engineering. This special section presents several recent approaches to the design of nonlinear and intelligent identifiers and controllers using some novel methods and advanced control techniques. A variety of applications in the areas of robotics, mechatronics, and others process control are also included.

This special section presents seven original articles, which are extended versions of selected papers from the 15th International Conference on *Electrical Engineering, Computing Science and Automatic Control (CCE 2018)*, held in Mexico City, Mexico. The conference received about 200 submissions, of which seven were suggested by the program committee for this special session. A brief description of their content follows.

The paper entitled *Fundamental limitations of the decay of generalized energy in controlled (discrete-time) nonlinear systems subject to state and input constraints*, by István Selek and Enso Ikonen, develops upper and lower barriers which bound the fastest admissible decay of a system's generalized energy over a set of feedback laws that make the closed-loop system asymptotically stable on a compact set including the origin. The paper *Multiquery motion planning in uncertain spaces: Incremental adaptive randomized roadmaps*, by Weria Khaksar, Md Zia Uddin and Jim Torresen, proposes a multi-query sampling-based planner based on an optimal probabilistic roadmap algorithm that employs a hybrid sample classification and graph adjustment strategy to handle diverse types of planning uncertainty such as sensing noise, unknown static and dynamic obstacles and an inaccurate environment map in a discrete-time system. Juan Pablo Flores-Flores and Rafael Martinez-Guerra present a paper called *PI observer design for a class of nondifferentially flat systems*, suggesting a methodology to design a proportional-integral reduced order state observer for a class of nondifferentially flat chaotic systems. The paper *A spectral method of the analysis of linear control systems*, by Alexander P. Kurdyukov and Victor A. Boichenko, considers a spectral method of the analysis of linear control systems. Edgar Estrada, Wen Yu and Xiaoou Li consider in their paper *Stability and transparency of delayed bilateral teleoperation with haptic feedback* that bilateral teleoperation systems have time-varying communication delays, are nonlinear, and have force feedback. The paper *A trajectory planning based controller to regulate an uncertain 3D overhead crane system*, by Carlos Aguilar-Ibanez and Miguel S. Suarez-Castanon, introduces a control strategy to solve the regulation control problem from the perspective of trajectory planning for an uncertain 3D overhead crane. Finally, the paper *Robust extremum seeking for a second order uncertain plant using sliding mode controller*, by Cesar Solis, Julio Clempner and Alexander Poznyak, suggests a novel continuous-time robust extremum seeking algorithm for an unknown convex function constrained by a dynamical plant with uncertainties.

The guest editors would like to take this opportunity to thank the authors for their input and effort. We believe that this collection of papers provides a significant contribution to control theory and will appeal to a broad audience as well as inspire future research in the field. We also would like to express our gratitude to all reviewers, who helped us ensure the high quality of this special section. We gratefully acknowledge their time and effort.

We also want to express special thanks to the journal Editor-in-Chief, Professor Józef Korbicz, for accepting this special section, as well as for his excellent co-operation and invaluable assistance.

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Julio B. Clempner holds a PhD in computer science from the Center for Computing Research at National Polytechnic Institute in Mexico. Dr. Clempner's research interests are focused on game theory and economics. One stream of his research is the use of Markov decision processes. A second stream includes optimization using extremum seeking. A third stream covers employing Petri nets. The final stream is related to optimization and Markov chains. He also is a member of the Mexican National System of Researchers (SNI) and several North American and European professional organizations, and is on editorial boards of several journals.

Enso Ikonen is a full professor and the head of the systems engineering research group at the University of Oulu in Finland. His professorship covers theory, methods and applications of control and systems engineering, particularly with applications in energy systems. He is an author of three books and more than 30 internationally reviewed journal articles, among well over 100 scientific publications. His research interests are in methods and applications of process control, including model-based process control, state estimation and computational intelligence in control.

Alexander P. Kurdyukov (1948–2018) graduated from the Moscow Institute of Electronic Machine Building (at present, the HSE Tikhonov Moscow Institute of Electronics and Mathematics) in 1972. After graduating from the MIEM, he started his career at the Institute of Control Sciences of the USSR Academy of Sciences (at present, the V.A. Trapeznikov Institute of Control Sciences of the Russian Academy of Sciences). A.P. Kurdyukov went up the career ladder from an engineer to the head of the Laboratory of Dynamics of Control Systems, named after the academician Boris N. Petrov, in 2007. Moreover, he was the last PhD student of Boris Petrov. Alexander Kurdyukov obtained a PhD degree in 1980 and a DSc degree in 2001, both in system analysis, data processing and control. He was a highly qualified specialist in the fields of coding theory as well as adaptive, robust and stochastic robust control. In the early 1990s, A.P. Kurdyukov, in cooperation with I.G. Vladimirov and A.V. Semyonov, became the founder of robust anisotropy-based control theory. Alexander Kurdyukov published more than 100 scientific works, including seven monographs in Russian and one monograph in English. Furthermore, he did significant scientific and social work: he was a member of editorial boards of *Automation and Remote Control*, *Control Sciences* (in Russian), and *Large-Scale Systems Control* (in Russian). He was also a member of the Academic Council of the V.A. Trapeznikov Institute of Control Sciences of the Russian Academy of Sciences, a member of the international public association called the Academy of Navigation and Motion Control, and a scientific secretary of the Russian National Committee on Automatic Control, which is the national members organization of IFAC. A.P. Kurdyukov actively worked with young scientists and had a great teaching experience. He taught at Bauman Moscow State Technical University and at the Moscow Institute of Physics and Technology; he gave lectures at universities in the Czech Republic, Italy, and Mexico. Under his supervision, one DSc and seven PhD theses were defended. Also, A.P. Kurdyukov was the chairman of the State Certification Commission at the HSE Tikhonov Moscow Institute of Electronics and Mathematics. In 2013, A.P. Kurdukov was awarded a B.N. Petrov State Prize of the Presidium of the Russian Academy of Sciences for the series of works on stochastic anisotropy-based theory of robust control. In 2016, A.P. Kurdyukov was awarded the title of an Honorary Worker in Science and Technology of the Russian Federation. In addition, A.P. Kurdyukov was the winner of V.A. Trapeznikov Institute of Control Sciences of the Russian Academy of Sciences prizes named after B.N. Petrov, A.M. Letov (twice) and V.S. Kulebakin, as well as the winner of the competition of the best works of the ICS. A.P Kurdyukov was awarded the honorary title of a Veteran of the Institute, a commemorative medal of 850 Years of Moscow, and the title of an Honorary Donor.