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Editorial- TOK2019 special issue

This special issue of *Transactions of the Institute of Measurement and Control* contains extended versions of the selected papers presented at the 21st Turkish National Conference on Automatic Control (TOK 2019) organised by Mugla Sitki Kocman University on 11–14 September 2019. TOK conferences are one of the most important activities of the Turkish Automatic Control National Committee, which was established under the International Federation of Automatic Control (IFAC). The current special issue includes nine papers from the conference, during which 108 papers were presented.

The first paper, by Yilmaz and Temeltas, proposes an affine iterative closest point variant based on the correntropy criterion and polar decomposition with the objective of enabling to use of these algorithms in the fine localization problem in mobile robotics. The method is applied to docking problem of smart automated guided vehicles used in factories in order to examine the fine localization performances of the proposed algorithms and their advantages are shown by comparing with the results of the rigid iterative closest point based approaches.

Cetin and Yenil examine the performance of inductor-capacitor-series compensation topology for both constant current and constant voltage charge control modes of an inductive power transfer circuit to charge an electric vehicle's (EV's) battery. The performance of the topology is compared to double-sided inductor-capacitor-capacitor compensation topology and their analyses are presented based on mutual inductance model. Their performance analyses during both charge control modes are presented in terms of the output voltage and the current regulations, which are also confirmed by field-electric common simulation by ANSYS software. According to the simulation results, inductor-capacitor-series topology shows better performance during constant current charge control mode.

Araz et al. introduce a two-stage method in order to design fixed-order data-driven $H\infty$ controller for mechanical systems. In the first stage, the unknown parameters of anti-resonance filter added to the control loop of the system to minimize resonant peaks are calculated using frequency domain data obtained from system identification tests while the $H\infty$ controller is calculated by solving an optimization problem under convex $H\infty$ constraints in the second stage. The method is tested experimentally on a military stabilized platform and its performance is compared to a model-based $H\infty$ controller design method.

Develer and Akar investigate the higher-order cluster consensus problem for multi-agent networks evolving over any given directed graph. They derive the necessary and sufficient conditions on the proposed distributed control law that ensure cluster agreement. The analysis demonstrates that appropriate choices of coupling strengths do not affect the cluster number and final values. The results are validated by numerical examples for third/fourth-order systems.

Odabas and Morgul design a Smith Predictor-based controller and an adaptive Coulomb friction observer, which is an extension of Friedland-Park observer, in order to improve position-tracking performance of a mechanical system with time delay. Different velocity predictor schemes are designed with the objective of guaranteeing its functionality with delayed measurements and their performances are compared. Simulation results demonstrate that the proposed control system enhances the tracking performance when the velocity is predicted with a high accuracy.

Aydin et al. present an approach to design an admittance controller for a physical human-robot interaction system by taking stability and transparency objectives into account. First, dynamical characterization of a collaborative robot is presented and then the stability and transparency analyses for the system are carried out. By superimposing the stability and transparency graphs, the allowable parameters for the admittance controller are determined and the effect of admittance controllers using some of the allowable parameters on the task performance is evaluated.

Nak and Ergenc develop a measurement method for angular displacements of an oscillation assisted micro drill device that is controlled to track a sinusoidal position reference. The measurement method based on the principle of monitoring the back-EMF voltage of the non-fed winding provides sensorless analog measurement of the angular displacement. The measurement and control methods are applied by using a digital signal processor and the experiments show that the method is effective for measuring angular displacements of rotational oscillations during cellular piercing operations.

Subasi et al. investigate the control of a fast steering mirror of an adaptive optics system to suppress the beam jitter. The fast steering mirror model based on the atmospheric turbulence data is developed using the system identification. A proportional-integral-derivative controller minimizing the $H\infty$ norm of the closed loop system is designed for the purpose of overcoming implementation problems. The

effectiveness of the PID controller is shown by the comparisons on the experimental setup.

Lastly, Akkaya et al. study the distributed control of connected vehicles via vehicle-to-vehicle communication and a mixed predecessor following topology is examined by considering communication and input delays. The system stability regions in delay space are obtained by using cluster treatment of characteristic root method in case of time delays, in which the kernel and offspring hyper-surfaces are determined using a Bezout resultant matrix based approach. It is shown that the proposed method confirms the internal stability of the connected vehicles under time delays, and the effectiveness of the proposed model is validated for internal and string stabilities through simulation studies.

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