Editorial

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The main aim of this special issue is to promote collaboration and knowledge transfer between researchers all over the world. The issue includes the top 10 selected papers out of 16 papers received from academicians, researchers and students from the related area, with the main emphasis on computation and algorithms.

The first paper has the title 'Controlling of lower-order dead system by implementing adaptive RST algorithm'. Since the advent of time, mankind has made numerous technological advances. Every system built is indeed time-varying in nature as well as nonlinear; hence, they tend to vary with time. Dead or slow systems tend to vary slowly; hence, controlling them is more challenging compared with other nonlinear systems. In order to control such systems, the authors implemented an RST-based control algorithm that can track the output response of the unknown system and control it with minimal error. τ is a quantity measured in time and it is a time-varying parameter for the lower order system, so it will change with time and in turn change the response of the entire system. Since the system is time varying, it is bound to change its coefficients at certain point in time, which changes the system, hence the previously applied control parameters might not be suitable to control the system. The least squares (LS) algorithm is used to track the changes occurring in the system with time, and thus changing the control parameter to complement the changes occurring in the system. The proposed algorithm of RST control design of slow time-varying system is compiled and simulated in the MATLAB environment. The proposed method is compared with the conventional PID controller, and it tracks the signal faster with the same amount of work force. It provides better

performance and it is more robust and effective than the traditional PID controller.

The second paper, titled 'Research on vibration compensation control of electromagnetic bearings rotor', aims at the micro vibration caused by mass imbalance of the high-speed magnetically suspended rotor. A novel electromagnetic force vibration compensation control method based on adaptive notch filter has been studied. Considering the influence of mass imbalance disturbance, the closed-loop control system model is established, and the internal relationship between mass imbalance and electromagnetic force disturbance is analysed. The simulation results show that the method can effectively suppress the influence of electromagnetic force induced by mass imbalance and reduce the micro vibration of the whole system.

In the third paper, 'Non-singular terminal sliding mode control of converter-fed DC motor system with mismatched disturbance compensation', the problem of angular velocity trajectory tracking for converter-fed DC motor system with both matched and mismatched disturbances is addressed, using a non-singular terminal sliding mode control. The combination of DC-DC power converters with DC motors for generating so-called smooth start of drives has numerous practical applications. Achieving high performance in such systems is however limited by the influence of unknown multiple disturbances. Furthermore, the conventional mathematical model used to express the dynamics of converter-fed motor systems effectively complicates the ability to compensate the multiple disturbances directly with control signal. In this paper, a control structure with a non-singular terminal sliding mode controller and a finite-time disturbance observer is proposed to address these practical issues. First, a special state transformation is applied, aggregating the acting disturbances and uncertainties in a sole perturbing term of the system expressed in new coordinates. Then, the observer estimates, in real-time, the information about the lumped disturbances based on already available input/output signals, and the obtained estimated signals (and their high order time-derivatives) are used to construct a sliding surface. Finally, the sliding mode controller is applied to achieve high performance of the resultant plant dynamics and to strengthen the governing scheme against modelling discrepancies. The efficiency of the proposed control method is validated through multi-criteria numerical simulations.

The fourth paper is 'Comparative analysis of simulator tools for unmanned aerial vehicle communication networks'. In recent years, the real-world problems are solved by researchers using simulation methods for experiments in the field of networks and communication. However, the simulator tools are generally used to assess the theories, ideas and hypothesis by research society. The unmanned aerial vehicle communication networks (UAVCN) is an emerging area, having many issues which could be explored. The development of a testbed to explore such issues is a major proposition. Hence, simulation tools are required to study UAVCN. Therefore, it is a more important task for researchers to select an appropriate simulator tool for specific research experiments. This paper presents the simulator tools ns2, ns3, JSim, MATLAB, OMNeT++, OPNET, QualNet, GloMoSim and AVENS. The various features of these tools and their pros and cons are discussed. Comparative analysis of features of the tools is highlighted in tabular form, and selected simulator tools are compared by implementing a routing protocol. In addition, the performance of the tools is evaluated in terms of memory usage and computation time, with respect to increasing the density of network nodes. Consequently, it is found that ns3 is more efficient than ns2, OMNeT++ and GloMoSim. In addition, the authors have established that, through these tools, researchers can explore and design the testbed scenarios and evaluate the performance of UAVCN.

The fifth paper, 'Single dimension-based fuzzy sliding mode control design for the stabilisation of underactuated unmanned underwater vehicle', provides a comparative analysis of traditional fuzzy-based sliding mode controller (F-SMC) and single dimension-based fuzzy sliding mode controller (SDF-SMC) for the stabilisation of an underactuated unmanned underwater vehicle (UUV). It has been observed that the sliding mode control design stabilises the underactuated mechatronic system very smartly, i.e., quadrotor craft, but it causes a high number of oscillations known as Zeno phenomenon. This effect can easily be eliminated using a fuzzy version of sliding mode controller (F-SMC) but at the same time it takes a long processing time owing to the fuzzification, inference and then defuzzification steps. The major reason for consuming such a lengthy time is the two-dimensional rule-based table. Thus, this research work turns that two-dimensional table of rules into a single dimension and proposes a single input-based fuzzy sliding mode controller (SDF-SMC), which generates crisp input. In addition, this paper presents the comparative simulation work between conventional F-SMC and SDF-SMC, carried on MATLAB/Simulink software to shorten the processing time. In order to validate the effectiveness of proposed control scheme, the SDF-SMC algorithm is also implemented using proper hardware and experimental setup.

The sixth paper is 'Manoeuvring control of an underactuated single rotor aircraft'. The purpose of this paper is to control the manoeuvring model of a single rotor unmanned aircraft (SRUA). SRUA delivers a more flexible and attractive solution with a characteristic of vertical takeoff and landing (VTOL) and hovering ability. This study also designs the control algorithm of this aircraft, and applies it control to the model with six degrees of freedom (DOF). Simulation results show that the designed control scheme has better stability and behaviour. A new configuration of a rotorcraft, as the research object, realises autonomous flight, according to the existing relevant practical experience, combining the theory of flight mechanics, automatic control, computer technology, and other related disciplines to design the rotorcraft flight control system. Analysis of the flight principle and structure

of the rotorcraft is evaluated and an analysis of the force and torque is carried out, establishing the mathematical model. In combination with the state equations, the coupling and stability of the aircraft are analysed to describe the control difficulties. A flight control strategy for the aircraft is presented and the control loop is designed, including the height control loop, speed control loop, and attitude control loop. After the simulation of several subjects, the proposed control strategy can realise the autonomous flight of the unmanned aircraft.

The seventh paper is 'Robust model reference adaptive control for five-link robotic exoskeleton. In this paper, H-infinity based model reference adaptive control (MRAC) for controlling the five-link lower limb robotic exoskeleton is developed during the single support phase with uncertainties and unknown external disturbances. Unlike classical MRAC, the presented scheme using H-infinity control and MRAC with adaptive error gain is proposed under uncertain parameter vector and external disturbance. For robustness, the H-infinity performance is applied to attenuate the impact of perturbation. Moreover, robust asymptotic stability of the overall system is investigated by Barbalat Lemma, selecting a suitable Lyapunov functional candidate. Finally, the efficacy of the developed scheme is validated by a relevant example.

The eighth paper is entitled 'An AI-driven automotive smart black box for accident and theft prevention'. The authors propose an automotive smart black box (SBB) for accident and theft prevention using artificial intelligence (AI). The SBB is a versatile device and can work with any type of vehicle, including electric and conventional cars. It has five smart features, including constant facial recognition through AI to identify the driver's face and detect drowsiness. Drowsiness detection will help to avoid catastrophic disasters by alarming the drivers if they are about to fall asleep. The SBB also has a 24/7 voice-recording feature that can be used to identify the reasons that caused the accident. Another feature is real-time vehicle tracking using global system for mobile communication (GSM) technology. The SBB would immediately notify the owner if there is any abnormal vehicle movement and help to prevent theft. The main contribution of this study is to design an SBB that contains the five aforementioned features and to synergise these features without any of them malfunctioning. The black box will be a Raspberry Pi working on OpenCV for monitoring the car, and the details will be notify the user via a network connection to his Android application for a more efficient approach. Experimental results prove the efficacy of the designed SBB in recording the relevant information and helping to prevent both accidents and thefts of vehicles.

The ninth paper 'Formation control of multiple UAVs using PID control approach', studies the formation control of multiple UAVs using PID algorithm. In formation control flight mode, the system uses a control law for keeping the UAVs in formation within the core of the multi-UAV formation itself. At present, most of the formation researches use the particle model or the autopilot model. This paper contains details of establishing UAV models, flight controllers and track formation to keep the system design consistent in closed loop formation. The full formation of the system is to maintain control law, in order to promote a consistent message. The authors study the construction of the team, its model, the formation of the geometric description, and the collaborative model variables that are used in UAVs. They investigated the detailed design collaboration of flight and track control algorithms, not only for formation of a stable internal formation, but also to let the whole formation suppress the predetermined route.

The tenth and final paper is 'Path planning of hovercraft using an adaptive ant colony with an artificial potential field algorithm'. This study describes a novel strategy by combining the adaptive ant colony optimisation (ACO) method with the artificial potential field (APF) algorithm. The classic ACO algorithm has multiple limitations, such as falling into a local optimum, slow convergence rate, etc. This hybrid strategy aims to counter the aforementioned problems. The paper discusses the previous and current works in the relevant research area to better understand the solutions available and then tries to improve them. Then, the mathematical model of the hovercraft is presented. Afterwards, the novel hybrid method by using the adaptive ACO in conjunction with the APF method is designed. The authors use two different scenarios in simulation to test the validity of the designed strategy. First, the hybrid method is tested in an environment with predetermined obstacles. Secondly, a dynamic mission area with shifting obstacles is used to further prove the efficiency of the designed method. The simulation results prove that the designed strategy is more effective and robust than traditional ACO. It converges quicker and finds the most optimal path.