
Guest editorial: Special issue on new development of intelligent unmanned systems

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317

A collection of selected papers has been compiled in the Special Issue entitled “New Development on Intelligent Unmanned Systems”. This Special Issue was based on the innovative ideas and the latest research results presented at the 17th International Conference on Intelligent Unmanned System (ICIUS 2021), held at the Ho Chi Minh City, Vietnam, during 25–27th August 2021. ICIUS 2021, a well-established annual conference, was in its 17th event with a long time of conference track. The conference has been successful for many years in Seoul, Korea (2005, 2006), Bali, Indonesia (2007, 2010, 2015), Nanjing, China (2008), Jeju, Korea (2009, 2018), Chiba, Japan (2011), Singapore (2012), Jaipur, India (2013), Montreal, Canada (2014), Xi’an, China (2016), Tamsui, Taiwan (2017), and Beijing, China (2019). Since its start in 2005, ICIUS has become a well-established annual conference which addresses the rapidly developing field of intelligent unmanned systems (including Unmanned Aerial Vehicles (UAVs), Unmanned Ground Vehicles (UGVs), Unmanned Surface Vehicles (USVs), and Unmanned Underwater Vehicles (UUVs), etc.), robotics, automation, intelligent systems, biomimetics, control and computation while providing participants and attendees insight into the paths ahead for fundamental research, system development and technology deployment around the world. This special issue aims to serve as a forum to exchange knowledge and disseminate the selected papers to broader audience about the new development and innovative applications of all types of unmanned systems, payload and accompanying systems.

In this special issue, seven papers that highlight the originality and new contribution in the area of intelligent unmanned systems were selected. The papers have been arranged according to the topics of interest of the ICIUS 2021. A brief introduction for this special issue is summarized as follows.

The first paper is entitled Development of a novel V-frame octocopter: design, kinematic analysis and simulation using PID controllers with Ziegler Nichols tuning method, authored by Minh, T.B., Vo, H. and Hua, L.T. The study proposes a new platform of the V-frame octocopter kinematics analysis, designed on the CAD software. FEM analysis was presented for some important mechanical parts to find the highest stress and displacement under high load applied. In addition, the paper has shown V-frame octocopter simulation based on Simulink using the second method Ziegler- Nichols to find suitable parameters of the PID controller for roll and pitch angle. It is concluded that the block simulation is feasible for implementation and fast for checking the new algorithm when building the new platform of the robot. The V-frame octocopter is found to have better performance scores including high redundancy rotors, high payload capability and affordable cost than another multi-copter family.

With the multi-function capabilities, humanoid robots nowadays have been served in many fields such as medical, construction, and disaster response. The paper entitled State observer-based model reference adaptive balance control for one-leg stance by Tran, T.D., Duong, V.T., Nguyen, H.H. and Nguyen, T.T. proposes a novel approach to address the challenging problem of one-leg balancing task. By inserting an external balance mechanism to the back of the humanoid robot, it is suggested to support the balance of one leg in humanoid robot. This can be achieved as not only is the sideways balancing task separated



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from normal walking function but also does the balance mechanism ensure the humanoid robot's hip adduction not to exceed the threshold of a walking human. A model reference adaptive controller (MRAC) is employed using state observer to control the dynamic responses in presence of uncertainties. Simulation results are presented to evaluate the effectiveness of the proposed method.

The next paper also contributes to the innovative research of humanoid robots. It is entitled Hybrid adaptive control for series elastic actuator of humanoid robot and authored by Lanh, L.A.K., Duong, V.T., Nguyen, H.H., Kim, S.B. and Nguyen, T.T. Generally, humanoid robots usually suffer significant impact force when walking or running in a non-predefined environment that could easily damage the actuators due to high stiffness. The paper addresses the stable control challenge of a humanoid powered by the series elastic actuators (SEAs) in the walking process. A model reference adaptive control (MRAC) is developed with the back-stepping algorithm to deal with the parameter uncertainties in a humanoid's lower limb driven by the SEA system. Based on the good simulation results with stable system response, the paper proposes an effective control algorithm that can be widely applied for the humanoid-SEA system.

In the paper entitled Linear regression model and least square method for experimental identification of AMBU bag in simple ventilator, the authors Truong, C.T., Huynh, K.H., Duong, V.T., Nguyen, H.H., Pham, L.A. and Nguyen, T.T. study a simple controller for a low-cost medical device called Artificial Manual Breathing Unit (AMBU). An airflow is produced by squeezing the AMBU iteratively with the grippers, which imitates the motions of human fingers. This paper investigates the correlation between the exhausting airflow of the AMBU bag and the grippers angle of the BVM (bag-valve-mask) ventilator. A quadratic function of which coefficients are fitted over 98% within the range of 350–750 ml is defined from the experimental identification with a linear regression model and a least square method. Such a simple ventilator is potential for COVID-19 patient's treatment for primary and palliative care using locally accessible and low-cost components in some low-income countries. It can be a necessity to relieve high work pressure on medical bureaucracies in the pandemic.

The next three papers are categorized in the topic of control and computation of ICIUS 2021. With the rapid advancement of computational resources, Computational Fluid Dynamics (CFD) has been becoming a practical approach in many different fundamental studies and in the design of intelligent unmanned systems.

Numerical study of aerodynamic performance and flow characteristics of a centrifugal blower is authored by Le, T.-L., Nghia, T.T., Thong, H.D. and Son, M.H.K. A physical model of the air blower consisting of these main parts in a blower system: collector, impeller, outlet flange and volute casing, and the appropriate boundary conditions is investigated numerically with Reynolds averaged Navier–Stokes equations and $k-\epsilon$ turbulence model by ANSYS software. Parameters representing the blower's performance such as the total pressure, the efficiency and the flow rate are analyzed. It shows that the operating condition has a significant effect on the blower performance, and the pressure maintained inside the blower is higher for a larger impeller rotational speed.

The paper entitled Aerodynamic and structural performances of a single-stage transonic axial compressor with blade fillet radius with authors Chu, H.-Q. and Dinh, C.-T aims to clarify the effect of an additional geometry, i.e. a fillet radius, to the blades of a single-stage transonic axial compressor, NASA Stage 37, on its aerodynamic and structural performances by the commercial software and the one-way fluid–structure interaction (FSI) approach simulation. The simulation results are first validated with the experimental data for the aerodynamic performances. The paper then compares the structural performances between the models with and without fillets.

The High Altitude Long Endurance Unmanned Aerial Vehicle driven by a hybrid power between battery and solar panel is the object in the paper entitled Computational fluid

dynamics (CFD) based propeller design improvement for high altitude long endurance (HALE) UAV by Maulana, F.A., Amalia, E. and Moelyadi, M.A. The HALE UAV is designed with 63 kg maximum take-off weight MTOW, cruising at 22.1 m/s at an altitude of 60,000 ft and propelled by two propellers. The challenge in the design of these two propellers at high altitude is that they should provide adequate thrust in cruising in the low air density and low Reynolds number regime. The Larrabee method is first applied to obtain the propeller geometry with chord and twist distribution. The computation fluid dynamic (CFD) approach method is then followed to improve the design to match the generated thrust to the desired one. The study shows that a design improvement process using CFD is required as the thrust in the preliminary step by the Larrabee method is always about 20% higher than the thrust resulted from the CFD simulation. The analysis of propeller's performance in various mission profiles shows its operational capability from climbing flight phase at sea level to cruising flight at an altitude of 60,000 ft.

At the moment for the successful publication of this special issue, we would like to extend our heartfelt thanks to the Editors-in-Chief, the Editorial Board of the *International Journal of Intelligent Unmanned Systems* for their support and management from preparation until finalization of the selected papers of the 17th International Conference on Intelligent Unmanned Systems (ICIUS) 2021. The contribution from the authors is gratefully acknowledged. The guest editors would like to congratulate all authors for their efforts and excellent papers. It is our hope that the readers will find this special issue helpful and practicable especially its application in intelligent unmanned systems.

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