Editorial

Intelligent unmanned aerial systems is the theme that has been selected for this special issue. Six papers were selected and extended from the presented papers of the 14th International Conference on Intelligent Unmanned Systems (ICIUS 2018), which was held in Jeju Island, South Korea, on 20–23 August 2018. The International Society of Intelligent Unmanned Systems (ISIUS) is the main organiser of ICIUS conference series, which is an annual platform for researchers around the world who are active in the areas pertaining to intelligent unmanned systems, to interact amongst each other and share their high quality research findings. The extended version of the selected papers went through another blind reviewing process for acceptance in this special issue.

The six papers cover several technological aspects related to unmanned aerial systems, including the design, modelling, avionics, vision systems, aerodynamics characteristics and multi-UAV systems. Those papers show that the advancement in technology at present days that allow for the production of more sophisticated UAVs with high level of intelligent and autonomy as well as more complex tasks or missions.

Hedge *et al.* present a technical overview of tilt-rotor UAVs that will be useful for researchers who have great interests in this type of UAVs. The paper discusses modelling and design of controllers for autonomous vertical take-off and landing (VTOL) tilt-rotor hybrid UAVs. The modelling is presented in terms of dynamics modelling and model structure. Various platform design and flight control strategies of existing tilt-rotor UAVs are discussed. The paper also presents a comparison of various flight control systems and the one, which is designed using H optimization with loop shaping under external wind and aerodynamic disturbances for a six degrees of freedom UAV in which the pitch and angle of attack are controlled by proper canard and elevon commands. The designed controller provides better stability and robust performance.

A low-cost solution to accurate altitude control for mini quadrotor is proposed by Kim *et al.* using a typical MEMS inertial measurement unit and micro laser sensor. Low pass and Kalman filter are used to estimate roll and pitch angles, whereby both are controlled by a proportional-derivative (PD) controller. In obtaining the altitude control, MEMS laser sensor and the *z*-axis accelerometer of the IMU measure the velocity in *z*-axis and the altitude, respectively, and are used as feedback to control the altitude. This low-cost altitude control can provide accurate altitude control with a steady state error approximately 5 cm.

Besides flight control systems, navigation system is one of very important systems in UAV, especially in the condition whereby GPS systems are unavailable or radio signals are jammed during flights. In such situation, navigation is a challenging task, and is often relied on expensive systems, such as the inertial navigation systems, or a cheaper solution based on images captured during the flight. Jurevičius and Marcinkevičius propose a new benchmark dataset from aerial images from robotic simulator that can be used for map-based localization, visual odometry and SLAM for high altitude flights (100–3,000 m). The dataset consists of 100,000 aerial images captured from Gazebo robotic simulator with orthophoto maps as a ground plane. This dataset is considered as the largest dataset that is currently available. The images cover 33 km of flight distance with three different trajectories and altitudes from urban and forestry environment. This provides a solution to the missing benchmarking datasets for high altitude UAV flights.

Unmanned amphibious aerial vehicle (UAAV) is an interesting type of UAVs that gains increasing popularity amongst researchers in the last decade. This type of autonomous vehicles allows for more diverse applications as they can fly, travel on water and Earth's

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surface. Similar to the typical UAVs, the performances of these vehicles are affected by primary forces such as lift, thrust, weight and drag, which is the main component affecting the vehicle motion. Ganesan and Balasubramanian in their paper presents computational fluid dynamic analysis of a UAAV that aims to reduce the drag force. The analysis is performed for various surface geometrical profiles (or riblet configuration), with different angle of attack and vehicle speed conditions. The flow characteristics of the vehicle is validated by wind tunnel experiments.

Mukhlish, Page and Bain present a novel epigenetic-learning algorithm for decentralised multi-agent systems. The proposed algorithm improves the automatic swarm design by taking into account multi-agent settings and the environmental characteristics, which interact with the swarm. The algorithm incorporates evolutionary computation, a learning mechanism to obtain external stimulus from the environment and a regulatory function, which combines the first two techniques into an epigenetic layer.

The 2D lumped wake vortex method for unsteady flapping motion is presented by Talarico, Mazzeo and Denda. This novel method can handle highly unsteady flapping wing motions with improved accuracy and significant reduction in the computational time in finding a solution. By incorporating the viscosity effects to the original vortex method, it can eliminate the problem in finding the solution in CFD analysis of unsteady flapping motions for a large number of flapping cycles by controlling the pitching moment amplitude, which grows over time with multiple flapping cycles.

We hope this special issue is beneficial for researchers in the relevant fields. We thank all contributors and the editorial and publication team.

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