Preface

The current issue of the Indian Journal of Geo-Marine Sciences highlighted selected papers from two conferences held in 2010; namely, The International Conference on Underwater System And Technology: Theory and Applications 2010 (USYS'10) and International Conference on Intelligent Unmanned System (ICIUS'10). USYS'10 was focussed towards underwater applications of system and technology, while ICIUS'10 covered the broader research scopes for intelligent unmanned system.

A paper by Ya-Wen Huang et. al entitled "*Development of Tether Mooring Type Underwater Robots: Anchor Diver I and II*" proposes a new concept of underwater vehicle, in which the robot is moored by a tether and utilizes the sea current for movement. Two tether mooring type of underwater vehicles, named "Anchor Diver I" and "Anchor Diver II" were also introduced. Anchor Diver I is an AUV (Autonomous Underwater Vehicles) developed for long-term ocean survey and Anchor Diver II is a ROV (Remotely Operated Vehicles) which moves with a principle similar to flying a kite in the sky. The paper by Koay et.al, on "*STARFISH - A Small Team of Autonomous Robotic Fish*", describes the development of a fleet of Autonomous Underwater Vehicles (AUVs) which have gained popularity in various research, commercial and military. The paper covered the intelligent cooperation between multiple vehicles with modular low-cost AUV specifically designed to support research on cooperation among a heterogeneous small team of AUVs. The STARFISH AUVs are based on an open architecture with a high degree of modularity and well-defined mechanical, electrical, and software interfaces. This enables the baseline AUV to be simple and low-cost, while allowing its capabilities to be extended with various specialized modules depending on the application. The paper by Maziyah Mat Noh et.al on "*Depth and Pitch Control of USM Underwater Glider: Performance Comparison PID vs. LQR*" describes the design of an optimal state feedback controller for USM underwater glider platform (USM-Glider). The glider mathematical model for motion control was obtained and two different models were obtained for the respective observations that relate ballast pumping rate to pitching angle and depth. The optimal performances were obtained via tuning of Qs and Rs matrices of the LQR and gain of K_p, K_i and K_d of the PID controller. Another paper by Faisal Sagala et.al on "*Development of Sea Glider Autonomous Underwater Vehicle Platform for Marine Exploration and Monitoring*" expounds on the preliminary design of sea glider autonomous underwater vehicle platform referred to as ITB-SGAUV. The ITB-SGAUV was designed to be compact in size, with the purpose of exploring and monitoring marine living resources. Its hardware is designed to be reconfigurable enabling the researchers to change the placement of the sensors for testing different navigation scenarios. Another underwater vehicle platform was developed by Muljowidodo. K et. al entitled, "*Design and Analysis of Laminar Hull SWATH Based Unmanned Surface Vehicle*". The Unmanned Surface Vehicle (USV) offers advantages for routine marine patrol operation. The USV was based on SWATH (Small Wetted Area Twin Hull) technology. It is very interesting to note the steps needed to develop an optimal USV platform.

For the control aspect, a paper by Agus Budiyono et.al entitled, "Development of Linear Parameter Varying Control System for Autonomous Underwater Vehicle" describes the development and application of Linear Parameter Varying (LPV) control system for robust longitudinal control system on an Autonomous Underwater Vehicle (AUV). The LPV system is represented as Linear Fractional Transformation (LFT) on its parameter set. The LPV control system combines LPV theory based upon Linear Matrix Inequalities (LMIs) and μ -synthesis to form a robust LPV control system. The LPV control design is applied for a pitch control of the AUV to fulfil control design criteria on frequency and time domain. The final closed-loop system is tested for robust stability throughout the operational envelope. Another paper by the same author, i.e. "*Model Predictive Control for Autonomous Underwater Vehicle*" investigates the use of Model Predictive Control (MPC). The characteristic of AUV where the dynamics is sluggish and linear around the region of operation makes the application of MPC amenable. In addition, the ability of the method to handle constraints inherent in the control inputs of AUV is appropriately exploited. Overall effectiveness of the new approach is evaluated based on the tracking performance, disturbance rejection and robustness.

The paper entitled "Adaptive Fuzzy Control of Unmanned Underwater Vehicles" by S. A. Salman et. al explores the the capability of adaptive network fuzzy inference system, namely ANFIS for modelling of UUVs and also to design a fuzzy controller using the ANFIS model. The emergence of swarming approach to control multi-agent system can be seen the paper by Zulkifli et.al entitled "*A Simulation based fly optimization algorithm for swarms of mini autonomous surface vehicles application*". The paper provide a detailed description of a new bio-inspired Metaheuristic Algorithm. The objective of the simulation is to understand the effect of the algorithm parameter on searching pattern strategy, as well as the possibility and the effectiveness of the proposed technique for the Swarm of mini Autonomous Surface Vehicles' (ASVs) application. For the data optimisation issue, the paper by Rosmiwati Mohd-Mokhtar et. al on "*Data Compression for Underwater Glider System Using Frequency Sampling Filters*" describes frequency sampling filters approach to compress the data and obtain meaningful parameter that describes the empirical model of the system. The use of finite impulse response model and the maximum likelihood method will play a role in eliminating the bias and noise effects of the glider data systems.

Another aspect of the underwater platform research is the mechanical system, controller and sensor modules development. The paper by A.M. Nawawi et. al on "*Optimization of underwater composite enclosure design using response surface methodology*" deals with the development of optimized design of composite underwater enclosure using response surface methodology (RSM), the box-like shape of enclosure was proposed by using Fiber Reinforced Polymer(FRP) composite materials. The "Pressure Hull Development Using Hybrid Composite With Metal Liner Concept" by Khairul Izman Abdul Rahim et. al describes the effort to reduce the total weight of underwater vehicle, while improving its strength characteristic. In this design, polymer composite is used as load bearing structure and metal liner has been introduced to prevent leakage from occurring within the system and also acts as a heat emission component. For the sensor device, paper by Mohd Ikhwan Hadi Yaacob et. al on "*Response Estimation of Micro-Acoustic Transducer for Underwater Applications using Finite Element Method*" deals with the modelling method to estimate the responses of micro-acoustic transducer and new design of micro acoustic transducer with nickel aluminium bronze encapsulation. The proposed method utilizes finite element analysis by combining the piezoelectric and modal harmonic analyses of micro-structured acoustic transducer. The proposed method is useful for micro acoustic transducer designer to determine responses before entering fabrication process. A slightly different approach was taken in the paper by Yek Hong Chua et. al on "*Using MTF with Fixed-zoning Method for Automated Gated Imaging System in Turbid Medium*". The paper utilised enhanced target images within the field of view (FOV) which ere fused into one 3D image. The Modulation Transfer Function (MTF) was selected as it can perform better in analyzing images under turbid condition. The paper on "*FPGA Design and Implementation of Embedded Multiprocessor Architecture forUnderwater Applications*" by Muataz H. Salih et. Al describes the design and implementation of embedded multiprocessors architecture system focusing on its design area and performance. The performances of a realistic application show scalable speedups comparable to that of the simulation. And finally, a paper by Hanita Daud et. al entitled "Development of EM Simulator for Sea Bed Logging Applications using MATLAB" presents a 1D modeling of electromagnetic waves for sea bed environment developed using MATLAB software. The paper focuses on two main areas; the first is on the simulator that is able to model plane layer modeling of the sea bed environment, by setting the deep of sea water, sediments and size and location of the hydrocarbon trap. While, the second focus is on the effect of electromagnetic waves called direct waves, reflected waves and refracted waves on the sea bed environment where potential hydrocarbon is present. Their work was based on Sea Bed Logging (SBL) application that uses marine controlled source electromagnetic (CSEM) sounding technique to detect and characterize hydrocarbon bearing reservoirs in deep water areas.

The papers selected cover the wide scope of underwater applications and its challenges. The potential for discoveries are always present. It is hope that an optimised integration of various disciplines will be beneficial to the long term goal of marine-resource research and development efforts.

Mohd Rizal Arshad & Agus Budiyono
Guest Editors