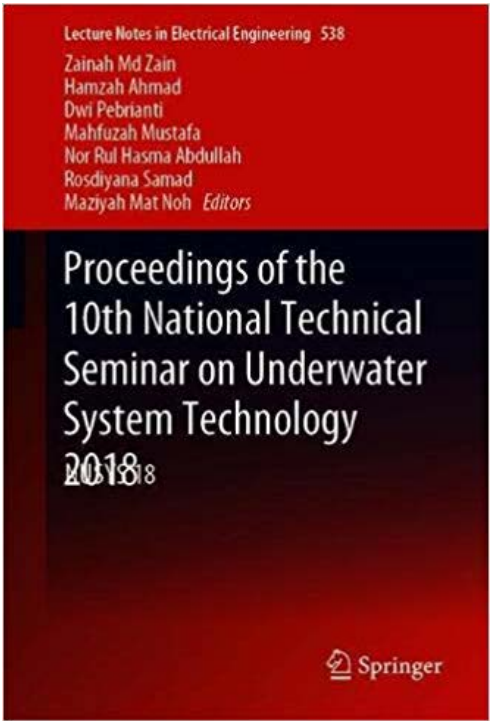

Proceedings of the 10th National Technical Seminar on Underwater System Technology 2018

NUSYS'18

Editors: **Md Zain**, Z., **Ahmad**, H., **Pebrianti**, d., **Mustafa**, M., **Abdullah**, N.R.H., **Samad**, R., **Mat Noh**, M. (Eds.)

ISSN 2194-5357 ISSN 2194-5365 (electronic)
Advances in Intelligent Systems and Computing
ISBN 978-3-030-00978-6 ISBN 978-3-030-00979-3 (eBook)
https://doi.org/10.1007/978-3-030-00979-3

Library of Congress Control Number: 2018955576

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

Design and Development of an Autonomous Underwater Vehicle for Underwater Target Navigation Mission Module 55
Muhammad Muzakkir Ahmad Roslan, Herdawatie Abdul Kadir, Khalid Isa, Radzi Ambar, Mohd Rizal Arshad, Maziyah Mat Noh and Mohd Helmy Wahab

Development of an Autonomous Underwater Vehicle for Target Acquisition 65
Leong Wai Lunn Alexander, Khalid Isa, Herdawatie Abdul Kadir and Radzi Ambar

Robust Controller Design for Autonomous Underwater Glider Using Backstepping Super Twisting Sliding Mode Control Algorithm 79
Maziyah Mat Noh, M. R. Arshad, Rosmiwati Mohd-Mokhtar, Zainah Md Zain, Qudrat Khan and Herdawati Abdul Kadir

PSpHT-II: A Water Strider-Like Robot with Cylindrical Footpad 99
Vi Vi Gan, Addie Irawan, Niirmel Ranjanendran and Siti Noor Zuliana

An Accurate Characterization of Different Water Properties Using Resonant Method for Underwater Communication Activity 113
Salwa Awang Akbar, Ahmad Syahiman Mohd Shah, Airul Sharizli Abdullah, Nurhafizah Abu Talip Yusof, Sabira Khatun, Syamimi Mardiah Shaharum and Mohamad Shaiful Abdul Karim

Statistical Relationship Between Multibeam Backscatter, Sediment Grain Size and Bottom Currents 121
Mohd Azhafiz Abdullah, Razak Zakariya and Rozaimi Che Hasan

Part II Control, Instrumentation and Artificial Intelligent Systems

Stabilization of Two-wheeled Wheelchair with Movable Payload Based Interval Type-2 Fuzzy Logic Controller 137
N. F. Jamin, N. M. A. Ghani, Z. Ibrahim, M. F. Masrom and N. A. A. Razali

Stabilization Control of a Two-Wheeled Triple Link Inverted Pendulum System with Disturbance Rejection 151
M. F. Masrom, N. M. Ghani, N. F. Jamin and N. A. A. Razali

Integration of PI-Anti-windup and Fuzzy Logic Control with External Derivative Solution for Leg's Robot Angular Joint Precision 161
Wan Mohd Nafis Wan Lezaini, Addie Irawan and Ahmad Nor Kasruddin Nasir

Integration of PI-Anti-windup and Fuzzy Logic Control with External Derivative Solution for Leg's Robot Angular Joint Precision

Wan Mohd Nafis Wan Lezaini[1] and Addie Irawan[2]

[1,2] Robotics and Unmanned System (RUS) group,
Faculty of Electrical & Electronics Engineering, Universiti Malaysia Pahang, 26600 Pekan, Pahang Malaysia.
wannafis93@gmail.com[1], addieirawan@ump.edu.my[2]

Abstract. Various ideas have presented in designing and developing the bio-inspired robot legged robot. Researchers may confront numerous challenges in designing control architecture of the legged robot, especially in controlling leg position. As the leg and joints number increases, the complexity of the multi-limbed system will increase. Thus, robust control is needed. For the case of motion precision in a legged robot, position control is essential to cater fast response of the angular motion during locomotion. Thus, this paper presents a modification on hybrid Proportional Integral with the antiwindup algorithm and Fuzzy Logic Control (PIA-FLC) with an external derivative element named as PIA-FLC-D to improve the speed of controller response for Hexaquad robot leg's joints. The proposed PIA-FLC-D control is validated on the first leg of Hexaquad robot, and the results were analyzed and compared with the previous PIA-FLC. The results show that the proposed PIA-FLC-D control had enhanced the performance of angular joint precision with fast response and minimal delay in each leg's joint motion tracking compares to the previous PIA-FLC controller.

Keywords: Legged Robot, Angular Precision, Anti-windup, Fuzzy Logic Control

1 Introduction

Generally, to enable a manipulator or legged robot moving around the workspace, it require a number of actuators which allowed it to affect the environment surrounding it by applying forces through the workspace or upon workspace [1]. Prismatic (telescoping) and revolute (rotary) are the types of joints that used in connecting between the two or more links of the robotics leg or manipulator depends on its application of usage. For an actuation system that used a revolute type of joint, mostly equipped which electric motor such as dc motor, stepper motor or servo as a direct actuation on the joint between the two robotic leg or manipulator links in which the feedback of actual joint position measured by the sensor connected the joint is supply to control system to control the motors rotation based on desired position. Differ to robot that equipped with