Advances in Science, Technology and Engineering Systems • *Open Access* • Volume 4, Issue 4, Pages 458 - 461 • 2019

Document type
Article • *Gold Open Access*

Source type
Journal

ISSN
24156698

DOI
10.25046/aj040455

View more

Design and control of autonomous surface vehicle to support bathymetry survey in the coastal environment

Zakki, Ahmad Fauzan[a] ; Triwiyatno, Aris[b]; Sasmito, Bandi[c]; Budiono, Krismon[b]

Save all to author list

[a] Naval Architecture Department, Engineering Faculty, Diponegoro University, 50275, Indonesia
[b] Electrical Engineering Department, Engineering Faculty, Diponegoro University, 50275, Indonesia
[c] Geodetical Engineering Department, Engineering Faculty, Diponegoro University, 50275, Indonesia

Abstract

Traditionally bathymetry survey is generally carried out using boat, research vessel, and small craft which is equipped with the echo sounding instrument and involves many persons as the vessel crew. The survey method demands an additional cost because of the extra man power and an expensive vessel operational cost. An autonomous surface vehicle (ASV) which is equipped with echo sounder was developed by adopting small water-plane area twin hull (SWATH) hull form to support bathymetry survey in the coastal environment. The paper is focused on the design of hull and control system of the SWATH-ASV, electronic device and sensor selection for control of the vehicle. The hull and control system is designed to organize the surface vehicle to perform the defined mission from ground control station. The hull form geometry, hardware and software of the SWATH-ASV and the control system are presented.

Source details

Advances in Science, Technology and Engineering Systems

Scopus coverage years: from 2016 to 2021

(coverage discontinued in Scopus)

Publisher: ASTES Publishers

E-ISSN: 2415-6698

Subject area: Engineering: Engineering (miscellaneous)

Business, Management and Accounting: Management of Technology and Innovation

Physics and Astronomy: Physics and Astronomy (miscellaneous)

Source type: Journal

CiteScore 2019
0.6

SJR 2021
0.188

SNIP 2021
0.294

View all documents > | Set document alert | Save to source list | Source Homepage

CiteScore | CiteScore rank & trend | Scopus content coverage

Improved CiteScore methodology

CiteScore 2019 counts the citations received in 2016-2019 to articles, reviews, conference papers, book chapters and data papers published in 2016-2019, and divides this by the number of publications published in 2016-2019. Learn more >

CiteScore 2019

$$0.6 = \frac{536 \text{ Citations } 2016 - 2019}{942 \text{ Documents } 2016 - 2019}$$

Calculated on 06 May, 2020

CiteScore rank 2019

Category	Rank	Percentile
Engineering Engineering (miscellaneous)	#48/61	22nd
Business, Management and Accounting Management of Technology and	#181/231	21st

View CiteScore methodology > | CiteScore FAQ > | Add CiteScore to your site

ASTES

Advances in Science, Technology & Engineering Systems Journal

VOLUME 4-ISSUE 4|JUL-AUG 2019

www.astesj.com
ISSN: 2415-6698

EDITORIAL BOARD

Editor-in-Chief

Editorial Board Members

Regional Editors

ADVANCES IN SCIENCE, TECHNOLOGY AND ENGINEERING SYSTEMS JOURNAL

Volume 4 Issue 4 **July-August 2019**

CONTENTS

ASTES

Advances in Science, Technology and Engineering Systems Journal Vol. 4, No. 4, 458-461 (2019)

www.astesj.com

ASTESJ

ISSN: 2415-6698

Design and Control of Autonomous Surface Vehicle to Support Bathymetry Survey in the Coastal Environment

Ahmad Fauzan Zakki[*,1], Aris Triwiyatno[2], Bandi Sasmito[3], Krismon Budiono[2]

[1]*Naval Architecture Department, Engineering Faculty, Diponegoro University, 50275, Indonesia*

[2]*Electrical Engineering Department, Engineering Faculty, Diponegoro University, 50275, Indonesia*

[3]*Geodetical Engineering Department, Engineering Faculty, Diponegoro University,50275, Indonesia*

A R T I C L E I N F O

Article history:
Received: 16 July, 2019
Accepted: 16 August, 2019
Online: 21 August, 2019

Keywords:
Small Water-plane Area Twin Hull
Autonomous Surface Vehicle
Bathymetry Survey

A B S T R A C T

Traditionally bathymetry survey is generally carried out using boat, research vessel, and small craft which is equipped with the echo sounding instrument and involves many persons as the vessel crew. The survey method demands an additional cost because of the extra man power and an expensive vessel operational cost. An autonomous surface vehicle (ASV) which is equipped with echo sounder was developed by adopting small water-plane area twin hull (SWATH) hull form to support bathymetry survey in the coastal environment. The paper is focused on the design of hull and control system of the SWATH-ASV, electronic device and sensor selection for control of the vehicle. The hull and control system is designed to organize the surface vehicle to perform the defined mission from ground control station. The hull form geometry, hardware and software of the SWATH-ASV and the control system are presented.

1. Introduction

Recently, the development of unmanned surface vehicle (USV) was made as an instrument that replaces the role of direct human involvement. Thus it might be useful to support the research activities such as data collection, survey and measurement in the remote and severe location with the ground control system. Many USV researches were made for oil and gas exploration, pipeline monitoring. The USV application for military operation can be found for surveillance, intelligence, search and rescue (SAR), inspection/exploration and strike missions.

In the scope of this research project, the prototype of autonomous surface vehicle was developed that will enable real time data monitoring to support bathymetry survey, especially in the coastal environment. The intact stability and the sea keeping characteristics of the developed autonomous surface vehicle were investigated in the previous study, [1]. In this paper, the study is focused on the design of the hull, propulsion system and the control system such as electronic device, sensor and data link. The SWATH hull form was selected that was expected to provide low resistance and excellent station keeping performance.

[*]Ahmad Fauzan Zakki, Naval Architecture Department, Diponegoro University, +622476480784, ahmadfauzanzakki@lecturer.undip.ac.id

2. Literature Review

Several articles which are related to the ASV design and control development can be found. An autonomous surface craft called ARTEMIS was designed by a research group in MIT for collecting the bathymetry data, [2]. ARTEMIS have two electric motors and a rudder for the propulsion system. It is equipped automatic heading and navigation control through the defined reference points that was used as the location of measurement point. Subsequently the catamaran was adopted for improving the intact stability and increasing the payload capacity.

In the other research, The DELFIM was developed as an Autonomous Underwater Vehicles (AUV), [3]. The ROAZ and ROAZ II was developed and designed for bathymetry survey, [4]-[5]. Furthermore the development of autonomous marine vehicle was represented by the SWORDFISH, MESSIN and SPRINGER. The SWORDFISH is equipped with the modular sensor for payload and a gateway for data communication from air to underwater environment, [6]-[7]. The catamaran hull form was used by MESSIN for hydrological mapping and oceanographic survey, [8]. The MESSIN able to operate in very shallow water and the autonomous navigation system was able to follow the defined route efficiently. In 2004, the SPRINGER was developed

ASTES

Advances in Science, Technology and Engineering Systems Journal Vol. 4, No. 4, 21-28 (2019)

www.astesj.com

Special Issue on Advancement in Engineering and Computer Science

ASTESJ

ISSN: 2415-6698

Emulation of Bio-Inspired Networks

Zdenek Kolka[*,1], Viera Biolkova[1], Dalibor Biolek[1,2], Zdenek Biolek[1,2]

[1]*Brno University of Technology, 616 00 Brno, Czech Republic*

[2]*University of Defence, 662 10 Brno, Czech Republic*

ARTICLE INFO

Article history:
Received:17 May, 2019
Accepted:10 June, 2019
Online: 09 July, 2019

Keywords:
Continuous-Time System
Discrete-Time System
Emulation
Neuron Modeling

ABSTRACT

The paper deals with hardware emulation of bio-inspired devices and nonlinear dynamic processes of complex nature by means of mixed-mode analog-digital emulators. The discretized state model of the emulated system serves for real-time calculation of dependent quantities. In contrast to input-output emulation known in control systems, the proposed approach emulates the ports of an electrical multiport network. The paper discusses the stability of the emulation process and the possibility of partitioning the system into two parts, one being emulated digitally and the other via an analog circuitry. The procedure is illustrated on the example of emulating the Fitzhugh-Nagumo model of neuron and the model of amoeba adaptation. The paper is an extension of our paper presented at the NGCAS 2018 conference in Valletta, Malta. The extended version deals newly with the choice of the integration method and provides a deeper stability analysis and more examples of emulation of biological models.

1. Introduction

Emulation consists in replacing a part of the electrical system with another system that has similar characteristics but is more convenient to implement. This technique has become popular in the field of electronic circuits with the (re)introduction of mem elements [1, 2]. For example, the memristors and other promising nanodevices for digital computational systems, massively parallel analog computations or elegant modeling of the neuron cells, are still in the experimental phase and are not available as off-the-shelf components. Emulation allows performing circuit experiments with equivalents of these novel elements and is also useful for demonstration and educational purposes [3].

The first emulators were proposed as analog circuits. Single-purpose emulators such as [4–6] are simple and elegant, but their disadvantage is the inability to change easily their characteristics. Emulators of memristive, memcapacitive and meminductive devices based on mutators provide large universality because they transform a nonlinear resistor, which can be easily modified, to the respective constitution relation of the mem element [7–8].

Another problem is the emulation of blocks with floating ports, which is difficult for purely analog emulators. Several two-terminal floating emulators were proposed [5, 9, 10]. However, all the emulators are based on grounded devices and are "floating" only in the case of neglecting parasitic parameters. In [11], a genuinely floating memcapacitor was proposed on the principle of switched capacitors. The first implementation of a floating resistive port using a mixed-mode system was proposed in [12] with the use of a digital potentiometer, whose resistance was controlled by a microcontroller by means of pre-programmed algorithms.

On the other hand, there are dynamic systems that cannot be emulated via the above single-purpose emulators. For example, the well-known Hodgkin-Huxley model of the cell membranes in a neuron is represented by a set of nonlinear differential equations [13]. The equivalent electrical model is a two-terminal device, consisting of a linear capacitor, two nonlinear memristive devices, and biasing sources [14]. Usually, these models contain large-value inductors and capacitors, which are not useful for practical laboratory experiments.

The demand for emulating general dynamic systems resulted in developing mixed-mode analog-digital emulators [15, 16]. They consist of a central digital unit, which controls one or more floating analog ports of three possible types: controlled voltage source, controlled current source, and digital potentiometer [17]. The independent port currents and voltages are digitally processed

[*]Corresponding Author: Zdenek Kolka, Brno University of Technology, Email: kolka@feec.vutbr.cz

ASTES

Advances in Science, Technology and Engineering Systems Journal Vol. 4, No. 4, 12-20 (2019)

www.astesj.com

ASTESJ

ISSN: 2415-6698

Permutation Methods for Chow Test Analysis an Alternative for Detecting Structural Break in Linear Models

Aronu, Charles Okechukwu[1,*], Nworuh, Godwin Emeka[2]

[1]*Chukwuemeka Odumegwu Ojukwu University (COOU), Department of Statistics, Uli, Campus, 431124, Nigeria*

[2]*Federal University of Technology Owerri (FUTO), Department of Statistics,460114, Nigeria*

ARTICLE INFO

Article history:
Received:22 February, 2019
Accepted:19 June, 2019
Online: 09 July, 2019

Keywords:
Chow Test
Economic Growth
Structural Break
Permutation Method

ABSTRACT

This study examined the performance of two proposed permutation methods for Chow test analysis and the Milek permutation method for testing structural break in linear models. The proposed permutation methods are: (1) permute object of dependent variable and (2) permute object of the predicted dependent variable. Simulation from gamma distribution and standard normal distribution were used to evaluate the performance of the methods. Also, secondary data were used to illustrate a real-life application of the methods. The findings of the study showed that method 1(permute object of dependent variable) and Method2 (permute object of the predicted dependent variable) performed better than the traditional Chow test analysis while the Chow test analysis was found to perform better than the Milek permutation for structural break. The methods were used to test whether the introduction of Nigeria Electricity Regulatory Commission (NERC) in the year 2005 has significant impact on economic growth in Nigeria. The result revealed that all the methods were able to detect presence of structural break at break point 2005. Also, the methods were used to test for structural break at January, 2015 for monthly reported cases of appendicitis in Nigeria. Result revealed that all the methods were able to detect presence of structural break at break point January, 2015.

1. Introduction

Detection of structural changes in economics has often pose a long standing problem in econometrics [1]. However, most existing tests are designed for structural breaks. Some researchers argued that it's un-likely that a structural break could be immediate and might seem more reasonable to allow a structural change to take a period of time to take effect. Hence, the technological progress, preference change, and policy switch are some leading driving forces of structural changes that usually exhibit evolutionary changes in the long term.

Structural break examines a shift in the parameters of the model of interest. However, when the conditional relationship between the dependent and explanatory variables contains a structural break, estimates of model coefficients will be inaccurate across different regimes [2]. As such, estimations that do not account for structural breaks will be biased and inconsistent.

According to [3], one of the traditional methods of detecting structural break is the Chow test analysis. The Chow test as a method of detecting structural break has the ability of testing for equality of sets of coefficients in two regression models. In this situation, part of the maintained hypothesis of the test is that the error variances will be the same for the two regressions. If this is not the situation, then the Chow test may be misleading and this can result to a situation where by the true size of the test (under the null hypothesis) may not be equal to the prescribed alpha-level. Due to problem like this, the present study will be proposing permutation methods for Chow test analysis for detecting structural break in a linear model.

The permutation test evaluates the probability of getting a value equal to or more extreme than an observed value of a test statistic under a specified null hypothesis. This is achieved by recalculating the test statistic after random shuffling of the data labels. Such tests are computationally intensive and the use of these tests never receive much attention in the natural and behavioral sciences until the emergence of widely accessible fast

*Charles Aronu, Email: amaro4baya@yahoo.com