AIM AND SCOPE

Journal of Mechatronics, Electrical Power, and Vehicular Technology (MEV) is an internationally peer-reviewed journal aims to provide authoritative global source of scientific information for researchers and engineers in academia, research institutions, government agencies, and industries. The Journal publishes original research papers, review articles and case studies focused on:

Mechatronics: including control system, robotic, CNC Machine, sensor, signal processing, electronics, actuator, and mechanical dynamics.

Electrical Power: including power generation, transmission system, new and renewable energy, turbine and generator design and analysis, grid system, and source assessment.

Vehicular Technology: including electric/hybrid vehicle design and analysis, vehicle on grid, fuel efficiency, and safety analysis.

Selected Applications: including all implementations or implications related to mechatronics, electrical power, or vehicular technology.

MEV's vision is to become an international platform with high scientific contribution for the global community. MEV's mission is presenting important results of work, whether in the form of research, development, application, or design.

IMPRINT

MEV is published by Research Centre for Electrical Power and Mechatronics - Indonesian Institute of Sciences (RCEPM-LIPI).

ISSN print: 2087-3379
ISSN electronic: 2088-6985

Electronics edition is available at: http://www.mevjournal.com

All published articles are embedded with DOI number affiliated with Crossref DOI prefix 10.14203

ACREDITATION

MEV has been certificated as an Indonesian Scientific Journal by Indonesian Institute of Sciences (LIPI). MEV has also been certificated by Ministry of Research, Technology and Higher Education (RTHE) as an online scientific journal.

Accreditation by LIPI:
Acc Number: 633/AU/P2MI-LIPI/03/2015
Acc date: 15 April 2015

Accreditation by Indonesian Ministry of RTHE:
Acc Number: 1/E/KPT/2015
Acc date: 15 September 2015

PUBLICATION FREQUENCY

MEV is managed to be issued twice in every year. The first issue should be in the mid of the year (July) and the second issue is at the end of the year (December).

PEER REVIEW POLICY

MEV reviewing policies are:

Every submitted paper will be reviewed by at least two peer-reviewers. Reviewers are unaware of the identity of the authors, and authors are also unaware of the identity of reviewers (double blind review method).
Reviewing process will consider novelty, objectivity, method, scientific impact, conclusion, and references.

POSTAL ADDRESS

MEV Journal Secretariat:
Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences (RCEPM - LIPI)
Komp LIPI Jl. Sangkuriang, Building 20, 2nd Floor, R209
Bandung, West Java, 40135 Indonesia
Tel: +62-022-2503055 (ext. 215)
Tel: +62-022-2504770 (ext. 203)
Fax: +62-22-2504773
Business hour: Monday to Friday 08:00 to 16:00 GMT+7
E-mail: sekretariat@mevjournal.com
Journal of
Mechatronics, Electrical Power, and Vehicular Technology
Volume 07, Issue 2, December 2016

ONLINE SUBMISSIONS
If you already have a Username/Password for Journal of Mechatronics, Electrical Power, and Vehicular Technology?
Go to login at: http://mevjournal.com/index.php/mev/login
Need a Username/Password?
Go to registration at: http://mevjournal.com/index.php/mev/user/register
Registration and login are required to submit items online and to check the status of current submissions.

COPY EDITING AND PROOFREADING
Every article accepted by MEV Journal shall be an object to Grammarly® writing-enhancement program conducted by MEV Journal Editorial Board.

PLAGIARISM CHECK
Plagiarism screening will be conducted by MEV Editorial Board using Crossref Similarity Check™ powered by iThenticate® and also using Grammarly® Plagiarism Checker.

REFERENCE MANAGEMENT
Every article submitted to MEV Journal shall use reference management software e.g. Endnote® or Mendeley.

OPEN ACCESS POLICY
MEV Journal provides immediate open access to its content on the principle that making research freely available to the public to support a greater global exchange of knowledge.

CC LICENSE
MEV Journal by RCEPM-LIPI allows reuse and remixing of its content under a CC BY-NC-SA Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License. Permissions beyond the scope of this license may be available at http://www.mevjournal.com.
If you are a nonprofit or charitable organization, your use of an NC-licensed work could still run afoul of the NC restriction, and if you are a for-profit entity, your use of an NC-licensed work does not necessarily mean you have violated the term.

PROCESSING CHARGES
Every article submitted to MEV Journal will not have any Article Processing Charges. This includes submission, peer-reviewing, editing, publishing, maintaining and archiving, and allows immediate access to the full text versions of the articles.

INDEXING & ABSTRACTING
MEV has been covered by these following indexing services:
EBSCOhost, Directory of Open Access Journal (DOAJ), Google Scholar, Crossref, Indonesian Scientific Journal Database (ISJD), Indonesian Publication Index (IPI), CiteULike, Cite Factor, Academic Journal Database, ResearchBib, Bielefeld Academic Search Engine (BASE), WorldCat, Sherpa Romeo, Index Copernicus, Open Academic Journal Index (OAJI), Open Access Articles, ROAD: the Directory of Open Access Scholarly Resources, Toronto Public Library, Western Theological Seminary, Ghent University Library, and Electronic Journals Library.
At this moment, MEV Journal is currently under Scopus review.
Journal of
Mechatronics, Electrical Power, and
Vehicular Technology
Volume 07, Issue 2, December 2016

EDITOR-IN-CHIEF
Prof. Dr. Estiko Rijanto
Indonesian Institute of Sciences (LIPI), Komp LIPI JI Sangkuriang, Blg 20, 2nd Fl, Bandung 40135, Indonesia
estiko.rijanto@lipi.go.id

INTERNATIONAL EDITORIAL BOARD
Prof. Rosli bin Abu Bakar
Faculty of Mechanical Engineering, Universiti Malaysia Pahang
26600 Pekan, Pahang, Malaysia

Prof. Ir. Jamasri, Ph.D.
Department of Mechanical and Industrial Engineering, Gadjah Mada University
Jl. Grafika
No. 2, Yogyakarta, 55281, Indonesia

Prof. Tapan Kumar Saha
Electrical Engineering, The University of Queensland
St. Lucia, Qld 4072, Australia

Prof. Muhammad Nizam, S.T, M.T, Ph.D.
Department of Mechanical Engineering, Universitas Sebelas Maret Surakarta
Jl. Ir. Sutami 36 A, Surakarta, 57126, Indonesia

Prof. Taufik
Director of Electric Power Institute, California Polytechnique
San Luis Obispo, CA 93407, United States

Prof. Dr. Tagawa Yasutaka
Tokyo University of Agriculture and Technology
Naka-machi 2-24 – 16, Koganei – shi, Tokyo, 184 – 8588, Japan

Prof. Dr. Bambang Riyanto
School of Electrical Engineering and Informatics, Bandung Institute of Technology
Jl. Ganesha No. 10, Bandung 40135, Indonesia

Prof. Dr. Ir. R. Danardono Agus Sumarsono, DEA, PE
Department of Mechanical Engineering, University of Indonesia
Kampus UI Depok 16424
Depok, Jawa Barat, Indonesia

Prof. Dr. Adi Soeprijanto
Department of Electrical Engineering, Faculty of Industrial Technology, Institut Teknologi Sepuluh Nopember (ITS)
Campus ITS Keputih, Surabaya 60111, Indonesia

Prof. Keum Shik Hong
Department of Mechanical Engineering, Pusan National University, Korea, Republic of

Prof. Josep M Rossell
Control, Dynamics and Applications (CoDAlab), Department of Mathematics Universitat Politècnica de Catalunya (UPC), Avda. Bases de Manresa, 61-73 08242 - Manresa (Barcelona), Spain

Assoc. Prof. John Young
School of Engineering and IT, The University of New South Wales, Australian Defence Force Academy, PO Box 7916, Canberra BC ACT 2610, Australia

Dr. Tatakripa Dirgantara
Mechanical and Aerospace Engineering, Bandung Institute of Technology, Jl. Ganesha No. 10, Bandung 40135, Indonesia

George Anwar, Ph.D.
University of California,
101 Sproul Hall, Berkeley, CA 94704, United States

Dr. Agus Sunjarianto Pamitran
Department of Mechanical Engineering, University of Indonesia
Kampus UI Depok 16424
Depok, Jawa Barat, Indonesia

Dr. Jose Guivant
School of Mechanical and Manufacturing Engineering, The University of New South Wales
Ainsworth Building (J17)
Level 3, Room 311B, Kensington Campus, Australia

Dr. Ir. Pekik Argo Dahono
School of Electrical Engineering and Informatics, Bandung Institute of Technology
Jl. Ganesha No. 10, Bandung 40135, Indonesia

Riza Muhida, Ph.D.
STIKP Surya
Jl. Scientia Boulevard Blok U/7 Summarecon Gading Serpong, Tangerang, Banten, 15810, Indonesia

Dr. Larissa Lorenz
Bauhaus Luftfahrt e.V., Lyonel-Feininger-Str. 28, 80807 Munchen, Germany

Dr. Arjon Turnip
Technical Management Unit for Instrumentation Development - LIPI
Komp LIPI JI Sangkuriang, Bld 40, Bandung 40135, Indonesia

Dr.Eng. Budi Prawara
Research Centre for Electrical Power and Mechatronics – LIPI
Komp LIPI Bandung, Blg 20, 2nd Fl, Bandung 40135, Indonesia
Journal of

Mechatronics, Electrical Power, and Vehicular Technology

Volume 07, Issue 2, December 2016

© 2016 RCEPM-LIPI. All rights reserved.
This journal and the individual contributions contained in it are protected under copyright by Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences (RCEPM - LIPI). And the following terms and conditions apply to their use:

Open Access Policy
MEV Journal provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge.

Copyright Notice
Authors who publish with this journal agree to the following terms:

- Authors retain copyright and grant the journal right of first publication with the work simultaneously licensed under a Creative Commons Attribution License that allows others to share the work with an acknowledgement of the work's authorship and initial publication in this journal.
- Authors are able to enter into separate, additional contractual arrangements for the non-exclusive distribution of the journal's published version of the work (e.g., post it to an institutional repository or publish it in a book), with an acknowledgement of its initial publication in this journal.
- Authors are permitted and encouraged to post their work online (e.g., in institutional repositories or on their website) after the acceptance and during the editing process, as it can lead to productive exchanges, as well as earlier and greater citation of published work.

Privacy Statement
The names and email addresses entered in this journal site will be used exclusively for the stated purposes of this journal and will not be made available for any other purpose or to any other party.

Notice
No responsibility is assumed by the Publisher for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein.

Although all advertising material is expected to conform to ethical (medical) standards, inclusion in this publication does not constitute a guarantee or endorsement of the quality or value of such product or of the claims made of it by its manufacturer.
FOREWORD FROM EDITOR-IN-CHIEF

Journal of Mechatronics, Electrical Power, and Vehicular Technology (JMEV) is an international journal indexed by Google Scholar, Directory of Open Access Journal (DOAJ), Indonesian Scientific Journal Database (ISJD), Indonesian Publication Index (IPI)/Portal Garuda, Crossref, Mendeley, CiteULike, Academic Journal Database, ResearchBib, Cite Factor, and others. Its Digital Object Identifier (DOI) Prefix is 10.14203.

In this issue, six papers are published with the total number of paper pages of 56 pages. Two papers are written by a principal author from Japan dan South Korea. Other authors come from Indonesia, Egypt, and Lybia.

One paper is related to mechatronics which describes aiming direction accuracy analysis of geometrical and numerical inverse kinematic approaches for two degrees of freedom robot manipulator. The manipulator degrees of freedom are azimuth and elevation angles. The analysis was carried out based on experiment results using circular error probable (CEP) and other statistical parameters.

Three papers address topics on electrical power. The first paper deals with a problem of designing load frequency control (LFC) in a multi area power system. It proposes a new design method through a selection of optimal LQR parameter values using artificial immune system (AIS) algorithm. The second paper describes a method to determine optimum sizing and placement of shunt capacitor in order to reduce line losses. The IEEE-14 bus test system is used for the case study. Derivative load bus voltage is simulated to determine the most sensitive load bus, while Particle Swarm Optimization (PSO) algorithm is carried out to determine the optimum size of shunt capacitor at the most sensitive bus. The third paper presents the design, implementation, and economic evaluation of a hybrid PV-Battery/Diesel electricity supply in Pulau Peucang, an isolated small island at the west of Java island Indonesia. Two different battery options were taken into account, lead-acid batteries and lithium-ion batteries. Levelized cost of energy (LCOE) of the system is explained. The results may also give a rough orientation for other locations which have similar characteristics.

In the scope of vehicular technology, there are two papers presented. The first paper builds a prototype of small-scale Electric Vehicle Simulator (EVS) and a simple charging scheme of the supercapacitor. A supercapacitor is one of electrical energy sources that have faster charging-discharging times when compared to other power sources, such as battery and fuel cell. The supercapacitor charging scheme is employed by controlling the relays. This scheme is simple, and it is useful for education purpose. The second paper reports results of performance comparison between diesel engine based range extender and gasoline engine based range extender. Fuel consumption and CO₂ emission are investigated through simulation. Single cylinder 499 cc gasoline engine and single cylinder 667 cc diesel engine are chosen. The simulation is performed using Japan 08 driving cycle.

Since the first volume, our journal provides discretion in the financial term by waiving the article processing charge. We are planning to improve the quality by registering the journal to other international academic citation index. We wish to offer our thanks to the Indonesian Institute of Sciences (LIPI) for their continuing unwavering support. Also, we would like to acknowledge our immense gratitude to our International Editorial Board members, reviewers, and authors.

We hope this publication would contribute to the enhancement of science and technology.

Bandung, December 2016

Editor-in-Chief
LIST OF CONTENTS

Derivative load voltage and particle swarm optimization to determine optimum sizing and placement of shunt capacitor in improving line losses

Mohamed Milad Baiek, Ahmad E. Esmaio, Muhammad Nizam, Miftahul Anwar, Hasan M.S. Atia ................................................................. 67-76

Simple supercapacitor charging scheme of an electric vehicle on small-scale hardware simulator: a prototype development for education purpose

Adnan Rafi Al Tahtawi, Arief Syaichu Rohman ................................................................. 77-86

Fuel consumption and CO\textsubscript{2} emission investigation of range extender with diesel and gasoline engine

Bambang Wahono, Arifin Nur, Achmad Praptijanto, Widodo Budi Santoso, Suherman, Zong Lu......................................................................................... 87-92

Optimal selection of LQR parameter using AIS for LFC in a multi-area power system

Muhammad Abdillah, Herlambang Setiadi, Adelhard Beni Reihara, Karar Mahmoud, Imam Wahyudi Farid, Adi Soeprijanto ........................................................................................................ 93-104

Accuracy analysis of geometrical and numerical approaches for two degrees of freedom robot manipulator

Hendri Maja Saputra, Midriem Mirdanies, Estiko Rijanto ........................................................................................................ 105-112

A hybrid PV-battery/diesel electricity supply on Peucang island: an economic evaluation

Matthias Günther ........................................................................................................ 113-122

Further articles can be found at http://www.mevjournal.com
Mohamed Milad Baiek¹, Ahmad E. Esmail², Muhammad Nizam³, Miftahul Anwar¹, Hasan M.S. Atta⁴ (Postgraduate program, Mechanical Engineering Department, Sebelas Maret University, Jl. Ir. Sutamri No. 36-A Surakarta, Indonesia; ⁵General Electricity Company of Libya (GECOL), GECOL Building, Jamahiriya Area 668 Tarabulus, Tripoli, Libya)

Derivative Load Voltage and Particle Swarm Optimization to Determine Optimum Sizing and Placement of Shunt Capacitor in Improving Line Losses

The purpose of this research is to study optimal size and placement of shunt capacitor in order to minimize line loss. Derivative load bus voltage was calculated to determine the sensitive load buses which further being optimum with the placement of shunt capacitor. Particle swarm optimization (PSO) was demonstrated on the IEEE 14 bus power system to find optimum size of shunt capacitor in reducing line loss. The objective function was applied to determine the proper placement of capacitor and get satisfied solutions towards constraints. The simulation was run over Matlab under two scenarios namely base case and increasing 100% load. Derivative load bus voltage was simulated to determine the most sensitive load bus. PSO was carried out to determine the optimum sizing of shunt capacitor at the most sensitive bus. The results have been determined that the most sensitive bus was bus number 14 for the base case and increasing 100% load. The optimum sizing was 8.17 Mvar for the base case and 23.98 Mvar for increasing load about 100%. Line losses were able to reduce approximately 0.98% for the base case and increasing 100% load reduced about 3.16%. The proposed method was also proven as a better result compared with harmony search algorithm (HSA) method. HSA method recorded loss reduction ratio about 0.44% for the base case and 2.67% when the load was increased by 100% while PSO calculated loss reduction ratio about 1.12% and 4.02% for the base case and increasing 100% load respectively. The result of this study will support the previous study and it is concluded that PSO was successfully able to solve some engineering problems as well as to find a solution in determining shunt capacitor sizing on the power system simply and accurately compared with other evolutionary optimization methods.

Keywords: particle swarm optimization; shunt capacitor; line losses.

Adnan Rafi Al Tahtawi¹, Arief Syaichu Rohman⁶ (Department of Computer Engineering, Politeknik Sukabumi, Jl. Babakan Sirna No. 25, Sukabumi, Indonesia; ⁶Laboratory for Control and Computer Systems, Institut Teknologi Bandung, Jl. Ganesha No. 10, Bandung, Indonesia)

Simple Supercapacitor Charging Scheme of an Electric Vehicle on Small-Scale Hardware Simulator: A Prototype Development for Education Purpose

Supercapacitor is one of electrical energy sources that have faster charging-discharging times when compared to other power sources, such as battery and fuel cell. Therefore, it is often used as an additional power source in an electric vehicle. In this paper, a prototype of small-scale electric vehicle simulator (EVS) is built and a simple charging scheme of supercapacitor is used for education purpose. EVS is an electric vehicle prototype which can show the vehicle’s powertrain on small-scale configuration. Main components of this device are two direct current motors (DCMs) with a linked axis of rotation. Therefore one of them will be able to act as a generator. The supercapacitor charging scheme is employed by controlling the relays. The hardware experimental result shows that the averages of charging current are proportional to the maximum slope angle of the road profiles. This scheme is simple due to the EVS utility and it is useful for education purpose.

Keywords: supercapacitor; charging; electric vehicle simulator (EVS); direct current motor (DCM).

Bambang Wahono¹,², Arifin Nur³, Achmad Praptijanto¹, Widodo Budi Santoso⁴, Suherman⁵, Zong Lu⁶ (Graduate School of Mechanical Engineering, University of Ulsan, San 29, Mugeo-dong, Nam-gu, Ulsan 44610, Republic of Korea; ⁷Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences (LIPI), Komplek LIPI, Jl. Sangkuriang, Gd. 20, Lt. 2, Bandung 40135, Indonesia; ⁸Brother Industries, Ltd. 15-1 Naeshiro-cho, Mizuho-ku, Nagoya, 467-8561, Japan)

Fuel Consumption and CO₂ Emission Investigation of Range Extender With Diesel and Gasoline Engine

Range extender engine is one of the main components of the range-extended electric vehicle (REEV) and together with a generator to extend the mileage of the electric vehicle. The main component of REEV is an electric motor, battery, and generator set that consist of generator and engine. In this study, we compared two models of REEV performance with two different types of the engine by simulation. Single cylinder 499 cc gasoline engine and single cylinder 667 cc diesel engine are chosen as the object of this research.
research especially relating to the utilization of the fuel consumption and CO2 emissions when fitted to an electric vehicle. The simulation was conducted by using AVL Cruise software and performed by entering the data; both experiment and simulation data, on all the main components of REEV. This simulation was performed in Japan 08 driving cycle. Based on the simulation, fuel consumption is reduced up to 35.9% for REEV with single cylinder diesel engine 667 cc compared to REEV with single cylinder gasoline engine 499 cc. The reduction of CO2 emissions from REEV with single cylinder 499 cc gasoline engine compared to REEV with single cylinder 667 cc diesel engine up to 30.47%.

Keywords: range extender engine; performance; diesel; gasoline; AVL Cruise.

Muhammad Abdillah$, Herlambang Setiadi³, Adelhard Beni Reihara$, Karar Mahmoud¹, Imam Wahyudi Fari², Adi Soeprijanto¹ (*Department of Cybernetics, Graduate School of Engineering, Hiroshima University 4-1, Kagamiyama Ichoke, Higashi-Hiroshma, 739-8527, Japan; ²Department of Electrical Engineering, University of Bhayangkara, Jl. Ahmad Yani 114, Surabaya, Jawa Timur 60231, Indonesia; ³Department of Electrical Engineering, University of Papua, Jln. Gunung Salju, Ambar, Manokwari, Indonesia; ⁴Faculty of Engineering, Aswan University, Sahara city-Airport Way, Aswan, 81528, Egypt)" Department of Electrical Engineering, Institut Teknologi Sepuluh Nopember, Building B, C & AJ Campus ITS Sukohiolo Surabaya, East Java, 60111, Indonesia)

Optimal Selection of LQR Parameter Using AIS for LFC in a Multi-Area Power System


This paper proposes a method to optimize the parameter of the linear quadratic regulator (LQR) using artificial immune system (AIS) via clonal selection. The parameters of LQR utilized in this paper are the weighting matrices Q and R. The optimal LQR control for load frequency control (LFC) is installed on each area as a decentralized control scheme. The aim of this control design is to improve the dynamic performance of LFC automatically when unexpected load change occurred on power system network. The change of load demands 0.01 p.u used as a disturbance is applied to LFC in Area 1. The proposed method guarantees the stability of the overall closed-loop system. The simulation result shows that the proposed method can reduce the overshoot of the system and compress the time response to steady-state which is better compared to trial error method (TEM) and without optimal LQR control.

Keywords: linear quadratic regulator (LQR); artificial immune system; clonal selection; load frequency control (LFC).

Hendra Maja Saputra, Midriend Mirdanies, Estiko Rijanto (Research Center for Electrical Power and Mechatronics, Indonesian Institute of Sciences, Komplek LIPI, Jl. Sangkuriang, Gd. 20. Lt. 2, Bandung 40135, Indonesia)

Accuracy Analysis of Geometrical and Numerical Approaches for Two Degrees of Freedom Robot Manipulator


Analysis of algorithms to determine the accuracy of aiming direction using two inverse kinematic approaches i.e. geometric and numeric has been done. The best method needs to be specified to precisely and accurately control the aiming direction of a two degrees of freedom (TDOF) manipulator. The manipulator degrees of freedom are azimuth (Az) and elevation (El) angles. A program has been made using C language to implement the algorithm. Analysis of the two algorithms was done using statistical approach and circular error probable (CEP). The research proves that accuracy percentage of numerical method is better than geometrical method, those are 98.63% and 98.55%, respectively. Based on the experiment results, the numerical approach is the right algorithm to be applied in the TDOF robot manipulator.

Keywords: azimuth; elevation; geometrical; numerical; C language.

Matthias Günther (Research Center for Renewable Energy and Energy Efficiency, Swiss German University, Edutown, BSD, 15339 Tangerang, Indonesia)

A Hybrid PV-Battery/Diesel Electricity Supply on Peucang Island: an Economic Evaluation


Renewable energy technologies are currently under a dynamic cost development. This case holds especially for solar technology that has reached price levels that were unimaginable until a short time ago. It also holds for battery technologies the application of which is related to the increasing usage of photovoltaic energy converters and the growing interest in electric vehicles. With the decreasing prices more and more possible application cases of renewable energy technologies become economically viable. A case study was done for a location on a small island located on the west tip of Java. The levelized electricity cost of a hybrid electricity supply system composed of a solar generator and battery in combination with the existing diesel generators was compared to the electricity generation cost of the existing system. Two different battery options were taken into account, lead-acid batteries and lithium-ion batteries. The results of this study can give a rough orientation also for other locations with similar characteristics.

Keywords: hybrid electricity supply; photovoltaics; lead-acid battery; lithium-ion battery; Peucang island.