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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:

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FOREWORD FROM EDITOR-IN-CHIEF

It is my pleasure to welcome you to the 1st issue of Volume 13 in the year 2022 of the Journal of Mechatronics, Electrical Power, and Vehicular Technology (MEV), a peer-reviewed and broad-scope international journal. This journal aims to bridge the gap in mechatronics, electrical power, and vehicular technology and is designed to advance scientific knowledge and foster innovative engineering solutions. It addresses both academics and practicing professionals, which has become an increasingly recognized international journal in the past years and indexed by many internationally recognized indexers.

This issue consists of ten papers written by authors from different countries, such as Taiwan, Malaysia, Germany, Turkey, Australia, United Kingdom, South Korea, Vietnam, Japan, Thailand, and Indonesia. The articles span a wide range of topics, from control system of robotic area to the study of carbon electrode sensitivity enhancement. Therefore, they may be classified as follows.

The first paper investigates pattern recognition based movement control and gripping forces control system on arm robot model using LabVIEW. The second paper identifies design and application of models reference adaptive control (MRAC) on ball and beam. The third paper presents the load optimization on the performance of combined cycle power plant Block 4 PT Indonesia Power Priok. The fourth paper discuss the improvement of power grid stability and load distribution using diesel excitation controller. The fifth paper in this issue aims to design and kinematic analysis of a two-DOF moving platform as a base for a car simulator. The sixth paper investigates the state of charge estimation of ultracapacitor based on equivalent circuit model using adaptive neuro-fuzzy inference system. The seventh paper explains the fabrication of nitrate ion sensor based on conductive polyaniline doped with nitrate using thick film technology. The eighth paper studies the two-sided manual machining method for three-axis CNC milling machine for small and medium-sized enterprises. The ninth paper investigates the production of hydrogen gas from water electrolysis on motorcycle engine. Last paper is about carbon electrode sensitivity enhancement for lead detection using polypyrrole, ionic liquid, and nafion composite.

Since the first volume, our journal provides discretion in financial terms by waiving the article processing charge. Finally, as the Editor-in-Chief of this promising journal, I would like to acknowledge our immense gratitude to our International Editorial Board members, reviewers, and authors for their excellent works and remarkable contributions.

Each issue of this journal offers valuable reports and articles to the practitioners and research experts. We encourage academic and research professionals to submit manuscripts on practical and scientific key issues in mechatronics, electrical power, and vehicular technology of all disciplines. We are looking forward to receiving extraordinary manuscripts and promoting cutting-edge technology development.

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

Bandung, July 2022

Editor-in-Chief

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ABSTRACTS SHEET

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Pattern recognition based movement control and gripping forces control system on arm robot model using LabVIEW

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 1-14, 21 ill, 2 tab, 18 ref.

Most arm robot has an inefficient operating time because it requires operator to input destination coordinates. Besides, main problem of arm robot is object's vulnerability when it is manipulated by the robot. This research goals is to develop an arm robot control system which has ability to automatically detect object using image processing in order to reduce operating time. It is also able to control gripping force for eliminating damage to objects caused by robot gripper. This research is implemented in LabVIEW 2011 software to control arm robot model which can represent industrial scale robot. The software is designed with informative visualization to help user learn and understand robotic control concept deeply. The system can automatically detect object position based on pattern recognition method which has four steps: pre-processing process to initialize picture taken by camera, segmentation process for separating object from the background, classification process to determine characteristics of object, and position estimation process to estimate object position in the picture. The object's position data are then calculated by using kinematic equation to control the robot's motion. The results show that the system is able to detect object and move the robot automatically with accuracy rate in x-axis is 95.578 % and in y-axis is 92.878 %. The system also implements modified PI control method with FSR as input to control gripping force with maximum overshoot value <10 %. Arm robot model control system developed is successfully meet the expectation. The system control can be implemented to industrial scale arm robot with several modification because of kinematic similarity between model and industrial scale robot.

(Author)

Keywords: arm robot model; LabVIEW based software; pattern recognition for position estimation; FSR based gripping force control.

Muhammad Zakiyullah Romdlony [a], Muhammad Ridho Rosa [a], Edwin Muhammad Puji Syamsudin [a], Bambang Riyanto Trilaksono [b], Agung Surya Wibowo [a, c] ([a] School of Electrical Engineering, Telkom University, Indonesia; [b] School of Electrical Engineering and Informatics, Bandung Institute of Technology, Indonesia; [c] Department of Electronics Engineering, NSCL Laboratory, Jeonbuk National University, South Korea)

Design and application of models reference adaptive control (MRAC) on ball and beam

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 15-23, 7 ill, 3 tab, 15 ref.

This paper presents the implementation of an adaptive control approach to the ball and beam system (BBS). The dynamics of a BBS are non-linear, and in the implementation, the uncertainty of the system's parameters may occur. In this research, the linear state-feedback model reference adaptive control (MRAC) is used to synchronize the states of the BBS with the states of the given reference model. This research investigates the performance of the MRAC method for a linear system that is applied to a non-linear system or BBS. In order to get a faster states convergence response, we define the initial condition of the feedback gains. In addition, the feedback gains are limited to get less oscillation response. The results show the error convergence is improved for the different sets of the sinusoidal reference signal for the MRAC with modified feedback gains. The ball position convergence improvement of MRAC with modified feedback gains for sinusoidal reference with an amplitude of 0.25, 0.5, and 0.75 are 35.1 %, 36 %, and 52.4 %, respectively.

(Author)

Keywords: model reference adaptive control; modified feedback gains; ball and beam system.

Louise Indah Utami [a], Ika Yuliyani [a], Yanti Suprianti [a], Purwinda Iriani [a, b] ([a] Energy Conversion Engineering Department, Bandung State Polytechnic, Indonesia; [b] Chemistry Department, University of Warwick, United

Kingdom)

Load optimization on the performance of combined cycle power plant Block 4 PT Indonesia Power Priok POMU

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 24-35, 19 ill, 7 tab, 15 ref.

Combined cycle power plant (CCPP) is a closed-cycle power plant, where the heat from the gas turbine's (GT) exhaust gas will be streamed to the heat recovery steam generator (HRSG) to be utilized by steam turbine (ST). CCPP Block 4 (Jawa-2) PT Indonesia Power Priok POMU has an installed capacity of 880 MW, consists of 2 GT units (301.5 MW each) and 1 ST unit (307.5 MW). The performance of a power plant depends on its load, as the efficiency of the turbine generator is low when operated at low loads. The data as of July 2019 showed that 2.2.1 (2 GT, 2 HRSG, 1 ST) configuration has been used in three conditions where the CC net load was around 30 – 45 %, which in fact could be compensated by the 1.1.1 (1 GT, 1 HRSG, 1 ST) configuration. This resulted in a decrease of the CC net efficiency up to 21.34 %. The optimization that can be done is to change the load configuration from 2.2.1 to 1.1.1 at 0 – 50 % of CC net load through simulations, by including the influence of the GT and HRSG start-up processes. The result of this optimization is that the CCPP performance increases due to higher performance of each turbine generator. Thus, the optimization results during July 2019 provided energy saving of 1,146.09 MMBTU or equivalent to cost saving of IDR 152,249,551.76.

(Author)

Keywords: combined cycle; gas turbine; steam turbine; load optimization; power plant performance.

Ehsan Ganji, Mehdi Mahdavian (Department of Computer Engineering, King Mongkut's University of Technology Thonburi, Thailand)

Improvement of power grid stability and load distribution using diesel excitation controller

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 36-47, 18 ill, 4 tab, 21 ref.

One of the requirements for controlling hybrid power systems is designing an appropriate excitation system, flexibility, protection, and coordination of all components to improve system stability. In this paper, various types of equipment simulated in the linear form and non-linear models are connected to the power supply. In the same direction, while presenting a new controller for the diesel generator excitation system and a filter used to purify and attenuate current harmonics is reported on the stability of a grid-independent system. Finally, the variation of the mode for the voltage and power of the system has been confirmed at the time of error and complete system stability. Also, the important indicators in the analysis are obtained in the lowest values, which can be seen from the controlled harmonics of the system of this data. In addition, the variation of the mode for the voltage and power of the system has been confirmed and the important indicators in the analysis are obtained in the lowest values.

(Author)

Keywords: hybrid power systems; Improve system stability; Non-linear control models; Excitation system; load distribution.

Bagus Made Arthaya [a], Raymond Christian [b], Tua Agustinus Tamba [a], Dilek Bilgin Tükel [c] ([a] Mechatronics Engineering Department, Faculty of Industrial Technology, Parahyangan Catholic University, Indonesia; [b] Faculty of Mechanical and Aerospace Engineering, Bandung Institute of Technology, Indonesia; [c] Software Engineering Department, Dogus University, Turkey)

Design and kinematic analysis of a two-DOF moving platform as a base for a car simulator

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 48-59, 13 ill, 0 tab, 25 ref.

The study starts by modeling a simple 2-DOF (degrees of freedom) moving platform that employs two actuators to provide two kinds of rotational motion on the moving platform and each motion is driven by an electrical motor. A preliminary study to better understand motion generation is conducted by deriving a mathematical model of the platform. Based on this model, the relationship between the rotations of the two driving motors and the pitch and roll movements of the platform is determined. The range of movements must be limited both in the pitch and roll planes to a certain maximum and minimum values of tilting angles. This preliminary design of the platform is introduced to demonstrate motions that might be experienced by the user in roll and pitch directions. The motion generated has fulfilled the constraint with respect to the vestibular system. Results of experimental works show that the first motor angle between -26° and 27° is suitable for the roll plane; meanwhile, the angles range of -52° and 54° for the second motor is suitable for the pitch plane. Furthermore, some simple experiments were conducted to examine the correctness of the model through the comparison between testing results obtained from simulation and experimental work. In the reported results, the moving platform was set to some initial poses and was driven to the home position and the recording showed acceptable results. This moving platform can later be used for more comprehensive experiments, i.e., vehicle dynamic testing, driving training purposes, and human factor analyses.

(Author)

Keywords: human vestibular system; kinematic model; moving platform; pitch and roll planes; rotating encoder.

Rizal Nurdiansyah [a], Novie Ayub Windarko [a], Renny Rakhmawati [a], Muhammad Abdul Haq [b] ([a] Electrical Engineering Department, Politeknik Elektronika Negeri Surabaya, Indonesia; [b] Department of Electrical Engineering and Computer Science, Tokyo Metropolitan University, Japan)

State of charge estimation of ultracapacitor based on equivalent circuit model using adaptive neuro-fuzzy inference system

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 60-71, 12 ill, 5 tab, 33 ref.

Ultracapacitors have been attracting interest to apply as energy storage devices with advantages of fast charging capability, high power density, and long lifecycle. As a storage device, accurate monitoring is required to ensure and operate safely during the charge/discharge process. Therefore, high accuracy estimation of the state of charge (SOC) is needed to keep the Ultracapacitor working properly. This paper proposed SOC estimation using the Adaptive Neuro-Fuzzy Inference System (ANFIS). The ANFIS is tested by comparing it to true SOC based on an equivalent circuit model. To find the best method, the ANFIS is modified and tested with various membership functions of triangular, trapezoidal, and gaussian. The results show that triangular membership is the best

method due to its high accuracy. An experimental test is also conducted to verify simulation results. As an overall result, the triangular membership shows the best estimation. Simulation results show SOC estimation mean absolute percentage error (MAPE) is 0.70 % for charging and 0.83 % for discharging. Furthermore, experimental results show that MAPE of SOC estimation is 0.76 % for random current. The results of simulations and experimental tests show that ANFIS with a triangular membership function has the most reliable ability with a minimum error value in estimating the state of charge on the Ultracapacitor even under conditions of indeterminate random current.

(Author)

Keywords: Ultracapacitors; state of charge; adaptive neuro-fuzzy inference system; energy storage devices; equivalent circuit model.

Charlotha [a], Roberth Viktoria Manurung [b], Aminuddin Debataraja [c], Indra Dwisaputra [a], Subkhan [d], Iqbal Syamsu [b, e] ([a] Electrical and Informatics Department, Politeknik Manufaktur Negeri Bangka Belitung, Indonesia; [b] Research Center for Telecommunication, National Research and Innovation Agency (BRIN), Indonesia; [c] Electro Engineering, Politeknik Negeri Jakarta, Indonesia; [d] Mechanical Engineering Department, Politeknik Manufaktur Negeri Bangka Belitung, Indonesia; [e] Institute of Semiconductor Technology (IHT), Laboratory for Emerging Nanometrology (LENA), Germany)

Fabrication of nitrate ion sensor based on conductive polyaniline doped with nitrate using thick film technology

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 72-78, 9 ill, 1 tab, 26 ref.

Nitrate is one of the nutrients that can give an effect on the environment if it is applied in excess. It is also easily soluble in water and it has the potential to be a pollutant in groundwater by the over-process of fertilizer. Therefore, it needs a detected component to give the right measure for nitrate in the soil, called a nitrate ion sensor. It consists of three electrodes configuration, namely, working, counter, and reference electrodes with conductive polyaniline doped with Nitrate (NO_3^-) which is fabricated by thick film technology. In previous research, acidic media was used as a solvent for polyaniline, while this research used water (H_2O) solvent. The result of characterization showed that particles were distributed evenly on the sample with the form of particles being small balls with a dimension of 0.18 µm and the percentage of atomic elements being: 91.96 % carbon, 3.14 % nitrogen, and 4.9 % oxygen. The performance of sensors was investigated using potentiostat with four concentrations of nitrate standard solution. The result showed good response with a voltage range in each concentration of nitrate standard solution being 0.5002 Volt (10 mg/l), 1.3552 Volt (20 mg/l), 1.1208 Volt (50 mg/l), and 0.8963 Volt (100 mg/l). It was found that nitrate sensors with nitrate-doped conductive polymer, polyaniline, as the sensitive membrane responded well to detecting nitrate elements in precision farming and the sensitivity showed that for every 1 mg/l concentration in nitrate standard solution, the voltage increases by 0.0007.

(Author)

Keywords: electropolymerization process; performance of nitrate sensor; the polyaniline; thick-film technology.

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Two-sided manual machining method for three-axis CNC milling machine for small and medium-sized enterprises

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 79-87, 14 ill, 4 tab, 23 ref.

Small and medium-sized enterprises (SMEs) have a big role in Indonesian economic development. The government has set four strategies in an effort to boost Indonesian economic development. One of the four strategies mentions the SMEs, and the other mentions the use of 4.0 technology. Working capital has been the main issue need to be considered in the SMEs. Thus, the affordability must be considered in the use of 4.0 technology in SMEs. One of the 4.0 technologies that are possible to be used in the SMEs is a three-axis milling machine. One of the limitations of the machine is that it cannot do the back-side machining process. The paper examines the possibility of manual back-side machining on the three-axis milling machine without adding a rotary axis. Four methods were conducted by adding two-point markings on the x-axis, two-point markings on the y-axis, four-point markings on the x- and y-axis, and four-point markings on the x- and y-axis plus a series of offsetting processes. After conducting several qualitative observations and measurements on the mismatched position of the front and the back machining, and also analyzing the problems that emerged during the processes of the four different methods, it is concluded that adding four points markings on the x- and y-axis plus doing a series of offsetting processes is the best method to have two-sided manual machining with three-axis computer numerical control (CNC) milling machine.

(Author)

Keywords: computer numerical control (CNC); small and medium-sized enterprises (SMEs); three-axis; two-sided machining.

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Study on the production of hydrogen gas from water electrolysis on motorcycle engine

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 88-94, 8 ill, 2 tab, 19 ref.

The primary emphasis of the research is on how to use hydrogen as an energy source for motorcycle fuel. This is an intriguing hypothesis to explore since, at the moment, fossil energy is used to meet fuel demands, although fossil energy supplies are running limited. As a result, hydrogen energy is an option that may be employed as a fuel substitute utilizing commercial water raw materials and the electrolysis method. The research goal is to demonstrate that electrolysis of water to hydrogen gas may occur while the vehicle is in use, to compute the amount of hydrogen gas generated, and to determine the time the vehicle can be utilized using the gas fuel created. The long-term goal of this study is to create a vehicle powered entirely by hydrogen gas produced by water electrolysis, particularly for motorcycles. The experimental approach was employed in this investigation, with three phases of testing on a carburetor-type motorbike utilizing 1, 2, and 3 liters of Pertamax gasoline. The results demonstrated that the process of electrolysis of water into hydrogen gas on motorcycles is possible; however, the amount of gas

generated is still quite little. The hydrogen gas generated by this electrolysis method is only 0.06 bar when 1 liter of fuel is used, 0.42 bar when 2 liters of fuel are used, and 0.98 bar when 3 liters of fuel are used.

(Author)

Keywords: alternative fuel; water electrolysis; brown gas.

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Carbon electrode sensitivity enhancement for lead detection using polypyrrole, ionic liquid, and nafion composite

Journal of Mechatronics, Electrical Power, and Vehicular Technology, 2022, vol. 13, no. 1, p. 95-100, 6 ill, 1 tab, 38 ref.

This paper concerns enhancing a lead detection sensor using a combination of polypyrrole (PPy), Nafion (N), and ionic liquid (IL) with thick-film or screen-printing technology on sensitive material-based carbon electrodes. Electrode characterization using a scanning electron microscope (SEM) was conducted to see the morphology of sensitive materials, showing that the spherical particles were distributed evenly on the electrode surface. Analysis using energy dispersive spectroscopy (EDS) shows that the element's atomic composition is 84.92 %, 8.81 %, 6.26 %, and 0.01 % for carbon, nitrogen, oxygen, and bismuth, respectively. Potentiostat measurement with the ambient temperature of 25 °C on a standard lead solution with concentration ranging from 0.05 to 0.5 mg/l yields an average output voltage ranging from 2.16 to 2.27 V. It can be concluded that the sensor is able to detect lead with a sensitivity of 0.21 V in each addition of solution concentration (mg/l) and give an 84 % concentration contribution to the voltage.

(Author)

Keywords: lead detection; thick film; polypyrrole; nafion; ionic liquid.