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AIM AND SCOPE

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FOREWORD FROM EDITOR-IN-CHIEF

Journal of Mechatronics, Electrical Power, and Vehicular Technology (MEV) has been 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 and Cite Factor. In addition, Digital Object Identifier (DOI) has been granted to our journal with DOI Prefix 10.14203.

In this issue, seven papers are published with the total number of paper pages of 66 pages. The selected papers in this issue have passed some levels of reviews and revisions based on the standard operating procedure of the journal. Three topics of the papers are related to mechatronics which address dynamical model of fixed wing UAV, control of quadrotors UAV and development of wireless accelerometer. Two topics are related to electrical power concerning radial rotor turbo-expander design for small organic rankine cycle system and prediction of battery state of charge using particle swarm optimization. Modeling, identification, estimation and simulation of urban traffic flow as well as economic valuation of hypothetical paratransit retrofitting are also presented in this issue.

Since the first issue, our journal provides discretion in 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 unwaving 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, July 2015

Editor-in-Chief

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ABSTRACTS SHEET

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Maria Clarissa Alvarez Carasco[a], Jan Pierre Potato Pizarro[a], Giovanni Alarkon Tapang[a] ([a]Versatile Instrumentation System for Science Education and Research National Institute of Physics, University of the Philippines Diliman, Quezon City, Philippines)

Development of a Microcontroller-Based Wireless Accelerometer for Kinematic Analysis

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2015, vol. 6, no. 1, p. 1-8, 9 ill, 0 tab, 15 ref.

Wireless Sensor Networks (WSNs) allow real-time measurement and monitoring with less complexity and more efficient in terms of obtaining data when the subject is in motion. It eliminates the limitations introduced by wired connections between the sensors and the central processing unit. Although wireless technology is widely used around the world, not much has been applied for education. Through Versatile Instrumentation System for Science Education and Research (VISSER), a project which aims to develop modern science laboratory equipment for high school education and research in the Philippines, a low cost WSN using nRF24L01+ RF transceiver that is developed to observe and analyze the kinematics of a moving object is discussed in this paper. Data acquisition and transmission is realized with the use of a low power and low cost microcontroller ATtiny85 that obtains data from the ADXL345 three-axis accelerometer. An ATtiny85 also controls the receiving module with a UART connection to the computer. Data gathered are then processed in an open-source programming language to determine properties of an object's motion such as pitch and roll (tilt), acceleration and displacement. This paper discusses the application of the developed WSN for the kinematics analysis of a toy car moving on flat and inclined surfaces along the three axes. The developed system can be used in various motion detection and other kinematics applications, as well as physics laboratory activities for educational purposes.

(Author)

Keywords: wireless sensor network; accelerometer; kinematics; nRF24L01+.

M. Qodar Abdurrohman[a], Reka Inovan[a], Ahmad Ataka[a], Hilton Tnunay[a], Ardhimas Wimbo[a], Iswanto[a], Adha Cahyadi[a], Yoshio Yamamoto[b] ([a]Department of Electrical Engineering and Information Technology, Gadjah Mada University, Jalan Grafika 2, Yogyakarta 55281; [b]Department of Precision Engineering, School of Engineering, Tokai University 1117 Hiratsuka-Shi, Kanagawa-Ken, Japan)

A Modified Gain Scheduling Controller by Considering the Sparseness Property of UAV Quadrotors

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2015, vol.6, no. 1, p. 9-18,15 ill, 0 tab, 9 ref.

This work presented the gain scheduling based LQR for Quadrotor systems. From the original nonlinear model, the system is always controllable and observable in various equilibrium points. Moreover, the linearized systems have a unique property that is known as sparse system. Hence, in order to implement the most efficient state feedback controller, post-filter and pre-filter were introduced to transform the state coordinate to decrease coupling between states. Finally, the gain scheduling systems using these facts was proposed. The system behavior was tested using the proposed controller. The numerical studies showed the effectiveness of the controller to achieve desired altitude, attitude, and its ability during the disturbance.

(Author)

Keywords: quadcopters; sparse system; linearization; gain scheduling; pole-placement.

Fadjar Rahino Triputra[a,c], Bambang Riyanto Trilaksono[a], Trio Adiono[a], Rianto Adhy Sasongko[b], Mohamad Dahsyat[c] ([a]School of Electrical Engineering and Informatics, Institut Teknologi Bandung, Jl. Ganesha 10, Bandung, Indonesia; [b]Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung, Jl. Ganesha 10, Bandung, Indonesia; [c]Agency for the Assessment and Application of Technology (BPPT), Komplek Puspiptek Serpong, Tangerang, Indonesia)

Nonlinear Dynamic Modeling of a Fixed-Wing Unmanned Aerial Vehicle: a Case Study of Wulung

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2015, vol. 6, no. 1, p. 19-30, 10 ill, 1 tab, 12 ref.

Developing a nonlinear adaptive control system for a fixed-wing unmanned aerial vehicle (UAV) requires a mathematical representation of the system dynamics analytically as a set of differential equations in the form of a strict-feedback systems. This paper presents a method for modeling a nonlinear flight dynamics of the fixed-wing UAV of BPPT Wulung in any conditions of the flight altitude and airspeed for the first step into designing a nonlinear adaptive controller. The model was formed into 10-DOF differential equations in the form of strictfeedback systems which separates the terms of elevator, aileron, rudder, and throttle from the model. The model simulation results show the behavior of the flight dynamics of the Wulung UAV and also prove the compliance with the actual flight test results.

(Author)

Keywords: fixed-wing UAV; nonlinear flight dynamics; strict-feedback systems.

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Prediction Model of Battery State of Charge and Control Parameter Optimization for Electric Vehicle

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2015, vol. 6, no. 1, p. 31-38, 6 ill, 5 tab, 15 ref

This paper presents the construction of a battery state of charge (SOC) prediction model and the optimization method of the said model to appropriately control the number of parameters in compliance with the SOC as the battery output objectives. Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences has tested its electric vehicle research prototype on the road, monitoring its voltage, current, temperature, time, vehicle velocity, motor speed, and SOC during the operation. Using this experimental data, the prediction model of battery SOC was built. Stepwise method considering multicollinearity was able to efficiently develop the battery prediction model that describes the multiple control parameters in relation to the characteristic values such as SOC. It was demonstrated that particle swarm optimization (PSO) succesfully and efficiently calculated optimal control parameters to optimize evaluation item such as SOC based on the model.

(Author)

Keywords: SOC; stepwise method; multicollinearity; electric vehicle; particle swarm optimization.

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Geometry Analysis and Effect of Turbulence Model on the Radial Rotor Turbo-Expander Design for Small Organic Rankine Cycle System

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2015, vol. 6, no. 1, p. 39-48, 7 ill, 4 tab, 11 ref.

Organic Rankine cycle (ORC) is one of the most promising technology for small electric power generations. The geometry analysis and the effect of turbulence model on the radial turbo-expanders design for small ORC power generation systems were discussed in this paper. The rotor blades and performance were calculated using several working fluids such as R134a, R143a, R245fa, n-Pentane, and R123. Subsequently, a numerical study was carried out in the fluid flow area with R134a and R123 as the working fluids. Analyses were performed using computational fluid dynamics (CFD) ANSYS Multiphysics on two real gas models, with the k-epsilon and shear stress transport (SST) turbulence models. The result shows the distribution of Mach number, pressure, velocity and temperature along the rotor blade of the radial turbo-expanders and estimation of performance at various operating conditions. The operating conditions are as follow: 250,000 grid mesh flow area, real gas model SST at steady state condition, 0.4 kg/s of mass flow rate, 15,000 rpm rotor speed, 5 bar inlet pressure, and 373K inlet temperature. By using those conditions, CFD analysis shows that the turbo-expander able to produce 6.7 kW and 5.5 kW of power when using R134a and R123, respectively.

(Author)

Keywords: radial turbo-expander; CFD; k-epsilon; shear stress transport; organic Rankine cycle.

Naili Huda[a], Kim Peter Hassall[b], Sunarto Kaleg[a], Abdul Hapid[a] ([a]Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences, Jl. Cisitu/Sangkuriang, Bandung 40135, Indonesia; [b]Department of Infrastructure Engineering, The University of Melbourne Level 02 Room C201 Engineering Block C, Parkville 3010, Australia)

Economic Valuation of Hypothetical Paratransit Retrofitting

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2015, vol. 6, no. 1, p. 49-56, 1 ill, 9 tab, 48 ref.

This paper describes a feasibility analysis of conventional and retrofitted paratransits, comparing economic performance of conventional paratransit with those using lead acid and lithium batteries. Research object is Dago-Kalapa paratransit in Bandung, West Java, travelling the distance of 11 km in town, under 8 peak hour operation. After calculating the estimated annual cost and benefit; net present value (NPV), payback period (PBP) and internal rate of return (IRR) then were quantified to provide feasibility description of those three paratransits. In addition, a sensitivity analysis regarding discount rate, gasoline price and battery price is given to offer broader sense of factors embraced. It is found that both gasoline and lead acid paratransit have big NPVs with only slight differences, while lithium paratransit has negative NPV. This phenomenon applies to their PBPs and IRRs as well. Only when gasoline costs reaches IDR 15,000 will electric paratransit prevails over conventional one. Thus, it can be inferred that at the moment, paratransit runs with gasoline is still the most cost effective compared to its counterparts. However, starting retrofitting from now is endorsed due to its environmental benefit.

(Author)

Keywords: feasibility; paratransit; conventional; electric; Bandung; Indonesia.

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Modeling, Identification, Estimation, and Simulation of Urban Traffic Flow in Jakarta and Bandung

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2015, vol. 6, no. 1, p. 57-66, 6 ill, 1 tab, 11 ref.

This paper presents an overview of urban traffic flow from the perspective of system theory and stochastic control. The topics of modeling, identification, estimation and simulation techniques are evaluated and validated using actual traffic flow data from the city of Jakarta and Bandung, Indonesia, and synthetic data generated from traffic micro-simulator VISSIM. The results on particle filter (PF) based state estimation and Expectation-Maximization (EM) based parameter estimation (identification) confirm the proposed model gives satisfactory results that capture the variation of urban traffic flow. The combination of the technique and the simulator platform assembles possibility to develop a real-time traffic light controller.

(Author)

Keywords: intelligent transportation system; stochastic hybrid system; state/parameter estimation; expectation-maximization; particle filter.