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Journal of Mechatronics, Electrical Power, and Vehicular Technology (MEV) is an international journal providing authoritative 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

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In this issue, seven papers are published with the total number of paper pages of 66 pages. The selected papers have passed high level of reviews and revisions based on the standard operating procedure of the journal. The authors come from Indonesia, Malaysia, Vietnam, Japan, Iraq, Australia, and United Kingdom. Four topics of the papers are related to mechatronics which address Empirical Mode Decomposition (EMD) method for characterization of random vibration signals, nonlinear tracking control of a 3-D overhead crane, review on the application of physiological and biomechanical measurement methods in driving fatigue detection, and optimized object tracking technique using Kalman filter. One topics are related to electrical power concerning CFD model for analysis of performance, water and thermal distribution, and mechanical related failure in PEM fuel cells. In the scope of vehicular technology there are two papers presented those are ABS based on Fuzzy Logic Control and cooperative braking in electric and hybrid vehicles.

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 2016

Editor-in-Chief

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ABSTRACTS SHEET

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Hardware Simulation of Automatic Braking System Based on Fuzzy Logic Control

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2016, vol. 7, no. 1, p. 1-6, 13 ill, 4 tab, 20 ref.

In certain situations, a moving or stationary object can be a barrier for a vehicle. People and vehicles crossing could potentially get hit by a vehicle. Objects around roads as sidewalks, road separator, power poles, and railroad gates are also a potential source of danger when the driver is inattentive in driving the vehicle. A device that can help the driver to brake automatically is known as Automatic Braking System (ABS). ABS is a part of the Advanced Driver Assistance Systems (ADAS), which is a device designed to assist the driver in driving the process. This device was developed to reduce human error that is a major cause of traffic accidents. This paper presents the design of ABS based on fuzzy logic which is simulated in hardware by using a remote control car. The inputs of fuzzy logic are the speed and distance of the object in front of the vehicle, while the output of fuzzy logic is the intensity of braking. The test results on the three variations of speed: slow-speed, medium-speed, and high-speed shows that the design of ABS can work according to design.

(Author)

Keywords: automatic braking system; advanced driver assistance system; fuzzy logic.

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A CFD Model for Analysis of Performance, Water and Thermal Distribution, and Mechanical Related Failure in PEM Fuel Cells

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2016, vol.7, no. 1, p. 7-20, 13 ill, 3 tab, 24 ref.

This paper presents a comprehensive three-dimensional, multi-phase, non-isothermal model of a Proton Exchange Membrane (PEM) fuel cell that incorporates significant physical processes and key parameters affecting the fuel cell performance. The model construction involves equations derivation, boundary conditions setting, and solution algorithm flow chart. Equations in gas flow channels, gas diffusion layers (GDLs), catalyst layers (CLs), and membrane as well as equations governing cell potential and hygro-thermal stresses are described. The algorithm flow chart starts from input of the desired cell current density, initialization, iteration of the equations solution, and finalizations by calculating the cell potential. In order to analyze performance, water and thermal distribution, and mechanical related failure in the cell, the equations are solved using a computational fluid dynamic (CFD) code. Performance analysis includes a performance curve which plots the cell potential (Volt) against nominal current density (A/cm^2) as well as losses. Velocity vectors of gas and liquid water, liquid water saturation, and water content profile are calculated. Thermal distribution is then calculated together with hygro-thermal stresses and deformation. The CFD model was executed under boundary conditions of 20°C room temperature, 35% relative humidity, and 1 MPA pressure on the lower surface. Parameters values of membrane electrode assembly (MEA) and other base conditions are selected. A cell with dimension of 1 mm x 1 mm x 50 mm is used as the object of analysis. The nominal current density of 1.4 A/cm^2 is given as the input of the CFD calculation. The results show that the model represents well the performance curve obtained through experiment. Moreover, it can be concluded that the model can help in understanding complex process in the cell which is hard to be studied experimentally, and also provides computer aided tool for design and optimization of PEM fuel cells to realize higher power density and lower cost.

(Author)

Keywords: CFD; PEM; fuel cell; multi-phase; hygro thermal stress.

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Application of Empirical Mode Decomposition Method for Characterization of Random Vibration Signals

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2016, vol. 7, no. 1, p. 21-26, 8 ill, 2 tab, 10 ref.

Characterization of finite measured signals is a great of importance in dynamical modeling and system identification. This paper addresses an approach for characterization of measured random vibration signals where the approach rests on a method called empirical mode decomposition (EMD). The applicability of proposed approach is tested in one numerical and experimental data from a structural system, namely spar platform. The results are three main signal components, comprising: noise embedded in the measured signal as the first component, first intrinsic mode function (IMF) called as the wave frequency response (WFR) as the second component and second IMF called as the low frequency response

(LFR) as the third component while the residue is the trend. Band-pass filter (BPF) method is taken as benchmark for the results obtained from EMD method.

(Author)

Keywords: EMD, BPF, IMF, vibration signals.

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Nonlinear Tracking Control of a 3-D Overhead Crane with Friction and Payload Compensations

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2016, vol. 7, no. 1, p. 27-34, 9 ill, 0 tab, 21 ref

In this paper, a nonlinear adaptive control of a 3D overhead crane is investigated. A dynamic model of the overhead crane was developed, where the crane system is assumed as a lumped mass model. Under the mutual effects of the sway motions of the payload and the hoisting motion, the nonlinear behavior of the crane system is considered. A nonlinear control model-based scheme was designed to achieve the three objectives: (i) drive the crane system to the desired positions, (ii) suppresses the vibrations of the payload, and (iii) velocity tracking of hoisting motion. The nonlinear control scheme employs adaptation laws that estimate unknown system parameters, friction forces and the mass of the payload. The estimated values were used to compute control forces applied to the trolley of the crane. The asymptotic stability of the crane system is investigated by using the Lyapunov method. The effectiveness of the proposed control scheme is verified by numerical simulation results.

(Author)

Keywords: 3-D overhead crane; nonlinear adaptive control; Lyapunov method; Euler-Lagrange equation; sway control.

Kadek Heri Sanjaya[a], Soomin Lee[b], Tetsuo Katsuura[c] ([a]Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences, 2nd Floor, 20th Building, Komplek LIPI, Jalan Cisitu No. 21/154D, Bandung, Indonesia; [b]Center for Environment, Health, and Field Sciences, Chiba University, 6-2-1 Kashiwa-no-ha, Kashiwa, Chiba Prefecture 277-0882, Japan; [c]Humanomics Laboratory, Graduate School of Engineering, Chiba University, 1-33 Yayoi-cho, Inage-ku, Chiba-shi, Japan)

Review on the Application of Physiological and Biomechanical Measurement Methods in Driving Fatigue Detection

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2016, vol. 7, no. 1, p. 35-48, 11 ill, 0 tab, 92 ref.

Previous studies have identified driving fatigue as the main cause of road traffic accidents, therefore, the aim of this literature review is to explore the characteristics of driving fatigue both physically and mentally as well as to explore the technology available to measure the process of fatigue physiologically. We performed e-searching in the field of fatigue detection methods through keywords tracking. The instruments studied have their own strength and weakness, and some are intrusive while the others are non-intrusive. The accuracy and stability of measurements are also varied between those instruments. In order to create more reliable fatigue detection methods, it is necessary to involve more instruments with an inter-disciplinary approach. Our intention is to make this study as a stepping stone for a more comprehensive in-vehicle real-time man-machine interaction study. Such study will not only be useful to prevent traffic accidents but also to bridge man and machine communication in the vehicle control along with developing newer technology in the field of vehicle automation.

(Author)

Keywords: driving fatigue; physiology; biomechanics; man-machine interface.

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Modeling and Design of Cooperative Braking in Electric and Hybrid Vehicles Using Induction Machine and Hydraulic Brake

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2016, vol. 7, no. 1, p. 49-56, 16 ill, 2 tab, 15 ref.

In mixed-mode braking applications, the electric motor / generator (M/G) and hydraulic pressure valve are controlled to meet the driver's braking demand. Controlling these braking elements is achieved by modulating the current generated by the M/G and adjusting the fluid pressure to the wheel brake cylinders. This paper aims to model and design combined regenerative and hydraulic braking systems which, comprise an induction electric machine, inverter, NiMH battery, controller, a pressure source, pressure control unit, and brake calipers. A 15 kW 1500 rpm induction machine equipped with a reduction gear having a gear ratio of 4 is used. A hydraulic brake capable to produce fluid pressure up to 40 bar is used. Direct torque control and pressure control are chosen as the control criteria in the M/G and the hydraulic solenoid valve. The braking demands for the system are derived from the Federal Testing Procedure (FTP) drive cycle. Two simulation models have been developed in Matlab®/Simulink® to analyze the performance of the control strategy in each braking system. The developed model is validated through experiment. It is concluded that the control system does introduce torque ripple and pressure oscillation in the braking system, but these effects do not affect vehicle braking performance due to the high frequency nature of pressure fluctuation and the damping effect of the vehicle inertia. Moreover, experiment results prove the effectiveness of the developed model.

(Author)

Keywords: mixed-mode braking, regenerative brake, induction machine, hydraulic brake, direct torque, pulse-wide modulation.

Liana Ellen Taylor[a], Midriem Mirdanies[b], Roni Permana Saputra[b] ([a]School of Engineering and Information Technology - Universityof New South Wales (UNSW), Canberra, ACT 2600, Australia; [b]Research Center for Electrical Power and Mechatronics, Indonesian Institute of Sciences (LIPI), Komplek LIPI Bandung, Jl. Sangkuriang, Gd. 20. Lt. 2, Bandung 40135, Indonesia)

Optimized Object Tracking Technique Using Kalman Filter

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2016, vol. 7, no. 1, p. 57-66, 14 ill, 5 tab, 16 ref.

This paper focused on the design of an optimized object tracking technique which would minimize the processing time required in the object detection process while maintaining accuracy in detecting the desired moving object in a cluttered scene. A Kalman filter based cropped image is used for the image detection process as the processing time is significantly less to detect the object when a search window is used that is smaller than the entire video frame. This technique was tested with various sizes of the window in the cropping process. MATLAB® was used to design and test the proposed method. This paper found that using a cropped image with 2.16 multiplied by the largest dimension of the object resulted in significantly faster processing time while still providing a high success rate of detection and a detected center of the object that was reasonably close to the actual center.

(Author)

Keywords: kalman filter; object tracking; object detection; cropping; color segmentation.