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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:

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FOREWORD FROM EDITOR-IN-CHIEF

Journal of Mechatronics, Electrical Power, and Vehicular Technology (MEV) is an international journal indexed by many internationally recognized indexers. Its Digital Object Identifier (DOI) Prefix is 10.14203. In this issue, six papers are published with the authors diversity came from Indonesia, Malaysia, Republic of Korea, Japan, Saudi Arabia and Germany.

The papers come from multidisciplinary topics including mechatronics, electrical power, and vehicular technology. They may be classified as follows. Four papers fall in electrical power topics. The first paper presents wireless power transfer. The second paper proposes single-stage regenerative organic Rankine cycle (ORC) performance byopen feed organic heater (OFOH). The third paper has the aim to deliver predictions of rotor tip displacement in the microturbine rotor assembly supported by a journal bearing under non-linear vibrations. The fourth paper describes lux and current analysis on lab-scale smart grid system using fuzzy-logic controller. One paper is related to mechatronics which address the swarm behaviour applied to drive a system consisting of six UAV quadrotors as agents for flocking while tracking a swarm trajectory. One paper deals with vehicular technology i.e. A study effects of injection pressure and wall temperature on the mixing process of NO_x and NH_3 in Selective Catalytic Reduction system.

Since the first volume, our journal provides discretion in financial term by waiving the article processing charge. 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 2020

Editor-in-Chief

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ABSTRACTS SHEET

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Swarm control of an unmanned quadrotor model with LQR weighting matrix optimization using genetic algorithm

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2020, vol. 11, no. 1, p. 1-10, 7 ill, 1 tab, 36 ref.

Unmanned aerial vehicle (UAV) quadrotors have developed rapidly and continue to advance together with the development of new supporting technologies. However, the use of one quadrotor has many obstacles and compromises the ability of a UAV to complete complex missions that require the cooperation of more than one quadrotor. In nature, one interesting phenomenon is the behavior of several organisms to always move in flocks (swarm), which allows them to find food more quickly and sustain life compared with when they move independently. In this paper, the swarm behavior is applied to drive a system consisting of six UAV quadrotors as agents for flocking while tracking a swarm trajectory. The swarm control system is expected to minimize an objective function of the energy used and tracking errors. The considered swarm control system consists of two levels. The first higher level is a proportional – derivative type controller that produces the swarm trajectory to be followed by UAV quadrotor agents in swarming. In the second lower level, a linear quadratic regulator (LQR) is used by each UAV quadrotor agent to follow a tracking path well with minimal objective function. A genetic algorithm is applied to find the optimal LQR weighting matrices as it is able to solve complex optimization problems. Simulation results indicate that the quadrotors' tracking performance improved by 36.00 %, whereas their swarming performance improved by 17.17 %.

(Author)

Keywords: unmanned aerial vehicle; quadrotor model; swarm model; proportional – derivative (PD) controller; linear quadratic regulator (LQR); optimization model; genetic algorithm.

Bayu Prasetyo [a], Faiz Syaikhoni Aziz [a], Anik Nur Handayani [a] , Ari Priharta [a], Adi Izhar Bin Che Ani [b] ([a] Electrical Engineering Department, Universitas Negeri Malang, Indonesia; [b] Faculty of Electrical Engineering, Universiti Teknologi Mara (UiTM), Malaysia)

Lux and current analysis on lab-scale smart grid system using Mamdani fuzzy logic controller

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2020, vol. 11, no. 1, p. 11-21, 14 ill, 7 tab, 15 ref.

The increasing need for electrical energy requires suppliers to innovate in developing electric distribution systems that are better in terms of quality and affordability. In its development, it is necessary to have a control that can combine the electricity network from renewable energy and the main network by means of voltage back-up or synchronization automatically. The purpose of this research is to create an innovative lux and current analysis on lab-scale smart grid system using fuzzy logic controller to control the main network, solar panel network and generator network to supply each other with lab-scale electrical energy. In the control, Mamdani fuzzy logic controller method is used as the basis for determining the smart grid system control problem solving by adjusting the current conditions on the main network and the light intensity conditions on the LDR sensor. Current conditions are classified in three conditions namely safe, warning, and trip. Meanwhile, the light intensity conditions are classified in three conditions namely dark, cloudy and bright. From the test results, the utility grid (PLN) is in active conditions when the load current is 0.4 A (safe) and light intensity is 1,167 Lux (dark). Then the PLN + PV condition is active when the load current is 1.37 (warning) and the light intensity is 8,680 lux (bright). Finally, the generator condition is active when the load current is 1.6 (trip) and the light intensity is 8,680 (bright). Based on the test results, it is known that the system can work to determine which source is more efficient based on the parameters obtained.

(Author)

Keywords: fuzzy logic; smart grid; lux and current; lab-scale.

Aam Muharam [a, b], Tarek Mahmoud Mostafa [c], Suziana Ahmad [a, d], Mitsuru Masuda [e], Daiki Obara [e], Reiji Hattori [a], Abdul Hapid [b] ([a] Applied Science for Electronics and Materials, Interdisciplinary Graduate School of Engineering Sciences, Kyushu University, Japan; [b] Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences, Indonesia; [c] Computer, Electrical, Mathematical Sciences and Engineering (CEMSE), King Abdullah University of Science and Technology, Saudi Arabia; [d] Faculty of Electrical and Electronic Engineering Technology (FTKEE), Universiti Teknikal Malaysia Melaka, Malaysia; [e] Automotive Products and Electronics Laboratories, Furukawa Electric Co., Ltd., Japan)

Preliminary study of 50 W Class-E GaN FET amplifier for 6.78 MHz capacitive wireless power transfer

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2020, vol. 11, no. 1, p. 22-29, 12 ill, 2 tab, 20 ref.

A preliminary study of Class-E radio frequency power amplifier for wireless capacitive power transfer (CPT) system is presented in this paper. Due to a limitation in coupling capacitance value, a high frequency operation of switching power inverter is necessary for the CPT system. A GaN MOSFET offers reliability and performance in a high frequency operation with an improved efficiency over silicon device. Design specification related to the parallel load parameter, LC impedance matching and experimental analysis of the amplifier is explored. An experimental setup for the proposed inverter and its integration with the CPT system is provided, and the power efficiency is investigated. As a result, by utilizing a 6.78 MHz resonant frequency and a 50 Ω resistive load, 50 W of power has been transmitted successfully with an end to end system efficiency over 81 %. Additionally, above 17 W wireless power transfer was demonstrated successfully in the CPT system under 6 pF coupling with the efficiency over 70 %.

(Author)

Keywords: Class-E power amplifier; wireless power transfer; capacitive power transfer; high efficiency; high frequency power source.

Ghalya Pikra [a], Nur Rohmah [b], Rakhmad Indra Pramana [a], Andri Joko Purwanto [a] ([a] Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences, Indonesia; [b] Research Unit for Clean Technology, Indonesian Institute of Sciences)

Open feed organic heater pressure analysis on single-stage regenerative organic Rankine cycle performance

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2020, vol. 11, no. 1, p. 30-37, 8 ill, 1 tab, 23 ref.

Single-stage regenerative organic Rankine cycle (SSRORC) is a system that is used for increasing the simple organic Rankine cycle (ORC) performance. Open feed organic heater (OFOH) addition in the ORC system increase power and efficiency of the system. This paper analyzes the SSRORC performance with a variation of P_6/P_1 ranges from 1.25 to 3.75 with an increment of 0.25, where P_6 is the OFOH pressure at the inlet side and P_1 is the pressure at the inlet pump 1, respectively. Hot water was used as the heat source with 100 °C and 100 l/min of temperature and volume flow rate as the initial data. R227ea, R245fa, and R141b were chosen as working fluids for performance analysis. The analysis was performed by calculating the heat input, heat loss, pump and turbine power, net power, and thermal efficiency through energy balance. Exergy input, exergy output, and exergy efficiency were analyzed through exergy balance. The results show that P_6/P_1 = 2 obtains the highest performance than the other pressure ratios for R227ea, while R245fa and R141b obtain the highest performance at P_6/P_1 = 2.25. R141b has better performance than the other two fluids with 10.97 % and 11.96 % of thermal and exergy efficiency. The results show that the ratio of OFOH pressure at the inlet side to the pressure at inlet pump 1 (P_6/P_1) in the middle value obtains the best performance.

(Author)

Keywords: single-stage regenerative organic rankine cycle; open feed organic heater; R227ea; R245fa; R141b.

Maulana Arifin [a,b] ([a] Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences, Indonesia; [b] Institute of Thermal Turbomachinery and Machinery Laboratory, University of Stuttgart, Germany)

Rotordynamics analysis of solar hybrid microturbine for concentrated solar power

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2020, vol. 11, no. 1, p. 38-44, 6 ill, 1 tab, 15 ref.

Microturbine based on a parabolic dish solar concentrator runs at high speed and has large amplitudes of subsynchronous turbo-shaft motion due to the direct normal irradiance (DNI) fluctuation in daily operation. A detailed rotordynamics model coupled to a full fluid film radial or journal bearing model needs to be addressed for increasing performance and to ensure safe operating conditions. The present paper delivers predictions of rotor tip displacement in the microturbine rotor assembly supported by a journal bearing under non-linear vibrations. The rotor assembly operates at 72 krpm on the design speed and delivers a 40 kW power output with the turbine inlet temperature is about 950 °C. The turbo-shaft oil temperature range is between 50 °C to 90 °C. The vibrations on the tip radial compressor and turbine were presented and evaluated in the commercial software GT-Suite environment. The microturbine rotors assembly model shows good results in predicting maximum tip displacement at the rotors with respect to the frequency and time domain.

(Author)

Keywords: microturbines rotor tip displacement; parabolic dish solar concentrator; rotordynamics model; journal bearing; non-linear vibration.

Muhammad Khristamto Aditya Wardana [a, b], Ocktaeck Lim [a] ([a] Department of Mechanical Engineering, University of Ulsan, Republic of Korea; [b] Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences, Indonesia)

A study effects of injection pressure and wall temperature on the mixing process of NO_x and NH_3 in Selective Catalytic Reduction system

Journal of Mechatronics, Electrical Power, and Vehicular Technology, July 2020, vol. 11, no. 1, p. 45-54, 9 ill, 3 tab, 17 ref.

Diesel engines are commonly used for public transportation on-road and off-road applications. Growth production of the diesel engine is very significant from year to year. Nitride Oxide (NO_x) from diesel engine was the one of the major sources of the air pollution. Selective Catalytic Reduction (SCR) has been successfully used to reduce NO_x from diesel engine with chemical reaction from ammonia (NH_3). The mixing reaction between NO_x and NH_3 reaction can produce steam (H_2O) and Nitrogen (N_2). However, ammonia uniformity pattern usualy not homogenization

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and the ammonia was difficult to mix with NO_x. The constant air flows incomplete to assist the spray injector to spread NH_3 to all corners of SCR. The impact study of turbulent phenomena and standard k-epsilon Low-Reynolds Number model to mixing process in SCR system using STARCCM+. The simulation studies are conducted under different pressure (4 to 6 bars), injection rate (0.04 g/s) and temperature (338 K – 553 K) and the high pressure and high velocity magnitude creating turbulent swirl flow. The ammonia decomposition process and mixing process with NO_x were investigated using box with optical access. The simulation and numerical study results validated using back pressure value and the distribution of NO_x concentration value from the catalyst outlet. The wall temperature will increase the urea evaporation to generate ammonia and gas pressure will increase the mixing process and chemical process in SCR system. These reactions enable to optimize the SCR system technology which eventually able to reduce the NO_x quantity from diesel engine.

(Author)

Keywords: diesel engine; wall temperature; wall impingement; urea water solution (UWS); urea injection; selective catalytic reduction (SCR).