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EXPERIMENTAL AND SIMULATION WORKS IN ELECTROMAGNETIC TECHNOLOGY

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Electromagnetism (EM) has created a tremendous technological evolution in our daily lives from "life style" gadgets to fundamental research laboratory applications, especially in exploring a kind of natural resources potential such as in geomagnetic, geothermal, groundwater and other fields. Since the 19-th century, Gaussian experiments with spherical harmonics indicated that the geomagnetic field originated from a core deep inside the Earth. The earth's geomagnetic field is not like the field of a bar magnet, but it is really generated by the motion of molten iron rich alloys that extends from the earth's inner core that changes over time. Due to that natural phenomenon, the research in the geomagnetic field is growing quickly, not only in terms of engineering aspects, but also in social aspects, such as the possible influence of the earth's magnetic field on human behavior.

This season, we are pleased to present the special edition of the International Journal of Technology (IJTech) dedicated to experimental and simulation works in electromagnetic technology to explore Indonesia's natural phenomena and Japanese earthquakes. This special edition presents nine selected papers from the International Conference on 1st AEMT (Applied Electromagnetic Technology) Lombok, 11-15 April 2014. Papers in this special edition generally can be divided into two groups. Papers 1-7 concern geomagnetic issues related to the phenomena of the earth's magnetic field. The rest of the papers present the development of electromagnetic simulations and devices for application at low-voltage levels.

The first paper, written by Zubaidah, Kanata, and Paniran is about the exploration of the geomagnetic field as a kind of potential natural field in the earth. The research aims are to construct and to concentrate the geomagnetic fields, in order to possibly use the concentrated fields for geomagnetic power plants. The designed geomagnetic concentrator system has been tested in a self-arranged, semi-anechoic chamber with a pair of Helmholtz coils, induced with DC currents to simulate regional ambient static geomagnetic fields. The results show that by inducing the 1 A current on each of the coils, this will produce magnetic fields, concentrated over the surrounding area of the Helmholtz coil. The intensities of magnetic fields over this area are about 15,000–45,000 nT, which can be used to model the geomagnetic fields of Lombok Island.

The second paper, authored by Warsa, Grandis, Parnadi, and Santoso, presents developing theory and the recent application of the Magnetic Resonance Sounding (MRS), as a non-invasive method which directly detects the groundwater's existence from surface measurements. Furthermore, a general formulation for inverting the initial amplitude and decay time of the MRS data to recover a 3-D distribution of groundwater is presented.

The third paper by Parnadi, Widodo, Savitri, and Zakarsyi presents their research in determining resistivity structure to a depth of 4 km by using Audio-magnetotelluric (AMT) and Magnetotelluric (MT) methods. The study results reveal the existence of a strike, as indicated from the geological data and a low-resistivity zone at a shallow surface to a depth of 2 km that is most probably associated with partial melting and intrusion at a greater depth.

The fourth paper by Kinasih, Wiriasto, Kanata, and Zubaidah presents findings leading towards analyzing and modeling earthquake interoccurence times in the Lesser Sunda Islands region using a Weibull distribution. Empirical results indicate the probability and rate of an earthquake recurrence time within a certain magnitude and in a certain time.

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Medium and weaker earthquakes have a higher chance of occurrence, reaching up to a 100% probability for the following 60 months. Meanwhile, a stronger earthquake has a 75.80% probability of occurrence.

The fifth paper by Kanata, Zubaidah, Ramadhani, and Irmawati, presents the changes of geomagnetic intensity in the atmosphere that might be used as an indicator of earthquake occurrences. Variations of geomagnetic data have been analyzed in association with the Tohoku Earthquake on March 11th 2011. The results showed that the difference power spectral density varies quite significantly, which can be observed over a period of 10 days before an earthquake occurrence.

The sixth paper by Wijaya, and Kencanawati focuses on wavelet based denoising. In this case, wavelet bases functions are investigated to determine the proper wavelet bases function to perform the denoising of an AE Signal. The experimental data shows that the best wavelet basis function for this case is Coiflet, which provides the best SNR in comparison with other wavelet families. In addition, the denoised AE signal has been successfully performed to determine the crack locations inside of the concrete, as is analysed by an AE parameter.

The seventh paper by Musafar, Triyanta, Sugitomo, Djamaluddin, Yoshikawa, and Uozumi investigates the dynamic pressure of solar wind controls to the power of Pc5 magnetic pulsations by performing a cross-spectrum analysis of Pc5 wavelets during the occurrence of electron radiation belts. The results indicate that the wavelet power of Pc5 magnetic pulsations, which is associated with a maximum wavelet cross spectrum, shows that a similar change of Pc5 pulsations occurs during radiation belt events. The increase of electron fluxes, which are initiated by the presence of the large power of the Pc5 magnetic pulsations, has been observed. This indicates that Pc5 magnetic pulsations could play a role in the acceleration and transport mechanism of the electron radiation belt.

The eighth paper by Satiawan, Citarsa, Wiryajati, and Aware presents a performance comparison of three PWM schemes of the dual-inverter fed five-phase, open-end winding motor drives. The quality of the phase output voltages is compared and adequate analyses are provided. The simulation results show that the Carrier Based Phase Disposition (PD) PWM scheme enables generation of the most excellent output voltage among the three PWM schemes. The Total Harmonics Distortion (THD) of the output voltages generated by the carrier based PWM scheme is reduced by 65% and 15% on average compared to the THD of the output voltages produced by the URS PWM scheme and the decomposition PWM scheme, respectively.

The last paper, written by Sulistiyanto, Rif'an, and Setyawati presents the development of a LED (Light Emitting Diode) driver based on a boost power converter. The selected driver´s prototype was realized using a FPGA (Field Programmable Gate Array) module as the switching controller, wherein the implementation using Xilinx ISE14.6 and the measurements were successfully performed. The boost converter topology was investigated to achieve an optimal converter, which showed a relatively high voltage gain.

With this special issue of our journal, we are successfully nearing completion of our publication for this year. We would appreciate your suggestions, feedback or any ideas which can help us to maintain and improve the journal's quality. I wish you all the happiest New Year 2015.

With warmest regards from the Editor's Desk,

Dr.-Ing Eko Adhi Setiawan
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