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Abstract Index

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Polyaniline as Novel Polymer Materials for Dry Electrode-Based Electrocardiography (ECG)

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Electrocardiography (ECG) has been instrumental for early detection of cardiovascular anomalies. In this research, we successfully prototyped and evaluated the performance of a novel dry electrode as ECG sensor. Copper was selected as dry electrode material due to its good balance between conductivity and affordability. Polyaniline was used as a conductive coating to facilitate the conversion of ionic currents from the human body into electrical currents in electronic circuits. The coating was carried out via electrodeposition technique. Optimal electrodeposition time of 20 minutes using acetic acid as a dopant was established. This yields in the dry electrode with comparable performance to the certified wet electrode currently available in the market, shown by PQRST signal correlation between dry electrodes (this study) and the wet electrode (benchmark) which is close to zero. The dry electrode prototyped in this study is characterized to have a conductivity of 7 x 10^{-4} S/mm, a resistance of 10 Ω, capacitive reactance of 140Ω, and excellent signal stability showing a value of 256.5 μV consistently for 2 hours.

Keywords: heart attack, early detection, electrocardiography (ECG), dry electrode, polyaniline, electrodeposition.

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Degradation of Shielding Performance of Metallic Sheet due to Aperture Configuration and Dimension at 2.4 GHz

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The increasing demand on wireless connectivity has opened new and modern communication systems. Many wireless systems, for example Wireless Fidelity (Wi-Fi), Bluetooth, ZigBee, share the unlicensed frequency region around 2.4 GHz. Due to intensive application of Wi-Fi systems, there are certain disturbance potentials observed. The Wi-Fi signals cause interference to ZigBee networks which are used for smart grid applications. In this work, the shielding effectiveness of a metallic enclosure with several apertures is studied. Based on analytical expression from the literature, the shielding effectiveness by varying the sheet thickness, number of apertures, and aperture patterns is calculated. Several measurements of Received Signal Strength Indicator (RSSI) are carried out. The measurements are conducted on a shielded room to isolate the measurement from other unknown signal sources.
The calculation and measurement of shielding effectiveness confirmed that more apertures on a shielding sheet will reduce the Shielding Effectiveness (SE). SE for one aperture for the case sheet thickness 0.7 mm and diameter of 12 mm reduce from 46.28 dB to 14.24 dB for 6 apertures. Bigger aperture diameters will also degrade the SE from 46.28 dB to 5.27 dB for aperture diameter 24 mm. The same condition can be concluded for the thickness 1.4 mm for aperture diameter of 12 mm. However a slightly different measurement results are obtained for the thickness 1.4 mm and aperture diameter of 24 mm. The thickness plays a significant role to attenuate the wave, so that SE is bigger than the calculated on.

Keywords: Electromagnetic shielding, shielding effectiveness, stainless steel, shielded box method.

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A Comparison of the Utilization of Carbon Nanopowder and Activated Carbon as Counter Electrode for Monolithic Dye-Sensitized Solar Cells (DSSC)

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Monolithic design is one of the most promising dye-sensitized solar cell (DSSC) architectures to develop, because it allows the elimination of one conductive substrate and offers the possibility for printing layer-by-layer of the materials that made up its structure. In this study, titanium dioxide-based monolithic type DSSCs were fabricated on a single fluorine-doped transparent oxide coated glass with TiO_2 as photoanode and porous ZrO_2 as spacer. The type of the carbon material used as the composite paste for the counter electrode was varied to see the effect on the solar cell efficiency. Four-point probes measurement revealed that the resistivity of the carbon layer synthesized using activated carbon exhibited slightly higher conductivity with a sheet resistance of 10.70 Ω/sq and 11.09 Ω/sq for activated carbon and carbon nanopowder, respectively. The efficiency of DSSC that uses activated carbon as counter electrode was higher (i.e. 0.221%) than the DSSC with carbon nanopowder (i.e. 0.005%). The better performance of DSSC with activated carbon as a counter electrode was due to its better conductivity and higher surface area compared to those of carbon nanopowder.

Keywords: carbon paste, counter electrode, dye-sensitized solar cells (DSSC).

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Analysis of Thermal Treatment Zirconia as Spacer Layer on Dye-Sensitized Solar Cell (DSSC) Performance with Monolithic Structure

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Monolithic Dye-Sensitized Solar Cells (DSSC) offers the prospect of lower material cost and require a simpler manufacturing process compared with conventional DSSC. This device is fabricated on a single Fluorine Tin Oxide (FTO) glass substrate that consists of a nanoporous TiO_2 photo anode layer, a ZrO_2 spacer layer, a carbon counter electrode layer, a dye, and an electrolyte. The spacer layer on the monolithic DSSC serves as electrolyte storage and insulating layer to separate between photoanode and counter electrode. Zirconia (ZrO_2) is often used as a spacer because it has high temperature resistant, high dielectric constant and has band gap between 5-6 eV. In this work, the effects of the thermal treatment of zirconia layer as a spacer layer on the performance of monolithic DSSC have been investigated. The cell's performance increases with the sintering temperature as well as indicated by the decrease in particle size. Co-sintering treatment with carbon counter electrode layer tends to drastically reduce cell's performance. The highest performance was obtained at a sintering temperature of 500 ^oC with a PCE of 0.22%, I_{sc} = 0.16 mA and V_{oc} = 0.71 V.

Keywords: monolithic, DSSC, spacer layer, zirconia, thermal treatment, performance, sintering.

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Analysis of Non Linear Frequency Modulation (NLFM) Waveforms for Pulse Compression Radar

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Non Linear Frequency Modulation (NLFM) method can suppress the peak sidelobe level without additional windowing function. NLFM doesn't require any weighting function because it has inbuilt one. NLFM has a variable frequency deviation function due to the relation between frequency and time of the signal which is not linear so that it is possible to suppress of peak sidelobe level. This paper studies the characteristic of various NLFM waveform, such as NLFM Tri Stage Piece Wise (TSPW), NLFM S, and NLFM Taylor. The study of Pulse Compression of NLFM waveform consists of three aspects. First, analysis of pulse compression performance. Second, analysis of background noise. Last, analysis of Doppler effects. The simulation is done using Matlab software. The lowest value Peak Sidelobe Level (PSL) of NLFM TSPW is about -20 dB while NLFM S and NLFM Taylor are about -32 dB and -39 dB. Additive White Gaussian Noise

(AWGN) and Doppler Effect influenced the value of PSL for each NLFM waveform. NLFM Taylor has the best NLFM waveform when the Doppler Effect and AWGN cause the value of PSL become high. Comparison between NLFM Taylor and Linear Frequency Modulation (LFM) is done in radar surveillance applications to analyze the detectability performance where the condition of Radar Cross Section (RCS) for each target has different significant value. The three targets are commercial airplanes, helicopter and fighter. For detectability performance, NLFM Taylor can detect more clearly than LFM conventional.

Keywords: NLFM, LFM, PSL, Pulse Compression Radar, Doppler Effect.

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Improvement of DSOGI PLL Synchronization Algorithm with Filter on Three-Phase Grid-Connected Photovoltaic System

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Synchronous Reference Frame Phase Locked Loop (SRF PLL) has been widely used for synchronization three-phase grid-connected photovoltaic (PV) system. On the grid fault, SRF PLL distorted by negative sequence component and grid harmonic that caused an error inestimating parameter because of ripple and oscillation. This workcombinedSRF PLL with Dual Second Order Generalized Integrator (DSOGI) and filter to minimize ripple and minimize oscillation in the phase estimation and frequency estimation. DSOGI was used for filtering andobtaining the 90^o shifted versions from the $v_{\alpha\beta}$ signals. These signals ($v_{\alpha\beta}$) were generated from three phase grid voltage signal using Clarke transform. The $v_{\alpha\beta}$ signal was the inputs to the positive-sequence calculator (PSC). The positive-sequence $v_{\alpha\beta}$ was transformed to the dq synchronous reference frame and became an input to SRF-PLL to create the estimation frequency. This estimation frequency from SRF PLL wasfiltered by the low-pass filter to decreasegrid harmonic. Moreover, the output of low-pass filter was a frequency adaptive. The performance of DSOGI PLL with filter is compared with DSOGI PLL, SRF PLL, and IEEE standard 1547(TM)-2003. The improvement of DSOGI PLL with filter gave better performances than DSOGI PLL and SRF PLLbecause it minimizedripples and oscillations in the phase and frequency estimations.

Keywords: Synchronization, DSOGI PLL, PSIM, Photovoltaic System, Grid connected.

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The Editor of JET would like to thank the wisdom and advice of many individuals who dedicated their considerable time and expertise in safeguarding the quality and high standard of academic integrity of the journal. We are greatly indebted to the expertise, dedication, and expeditious response of the following individuals for reviewing at least one and, in some cases, many manuscripts for the journal.

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