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Fractional-N PLL Synthesizer for FMCW Signal Generator with Dual-Mode Modulation Pattern

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Radar signal generator is a critical component in radar system as it determines the best achievable resolution. Single chip Fractional-N PLL synthesizer with built-in VCO and sweep modulator become more popular as Frequency Modulated Continuous Wave (FMCW) signal generator due to the simplicity and overall cost reduction. This paper presents a realization process and experimental result of dual-mode modulation pattern FMCW signal generator using HMC769LP6CE PLL. The PLL is controlled by ATMega328 microcontroller and Altera EPM240T100C5 CPLD to operate in two difference mode: 1-way sweep mode and 2-way sweep mode. The PLL is programmed with four different sweep bandwidth from 6.75–54 MHz for different range and resolution radar purpose. The performance of FMCW signal generator is measured using the output of passband signal spectrum. The experimental results indicate that the PLL-VCO with 2-way sweep mode has clearer frequency passband compared to 1-way sweep mode.

Keywords: FMCW, radar signal generator, PLL-VCO, sweep.

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Effect of Geometrical Structure to the Performance of Monolithic Dye-Sensitized Solar Cells

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Since invented for the first time, researchers in the world were focusing on how to increase the efficiency of dye-sensitized solar cells (DSSC) and reduce of the fabrication cost. Monolithic type of DSSC is one of the best solutions to reduce the fabrication cost due to the elimination of one of transparent conductive oxide (TCO) substrate. In this study, DSSC monolithic was fabricated layer by layer by using screen printing method. There are three layers that printed in each cell namely TiO2, ZrO2, and carbon before being injected with electrolytes. The geometrical structure of DSSC was varied to find the highest performance. From the I-V characteristics and incident photon-to-current efficiency (IPCE) characterization shows the highest efficiency is 0.137% and the highest conversion of photons to current occurs at around 510 nm wavelength, for a structure which has ZrO¬2 layer not crosses over the no-FTO area, while TiO2 layer half crosses the no-FTO area, this is most likely caused by the imperfection of the ZrO2 layer.

Keywords: DSSC, monolithic, geometrical structure, efficiency, I-V, IPCE.

Octa Heriana, Teguh Praludi, Chaeriah Bin Ali Wael (Research Center for Electronics and Telecommunication (PPET), Indonesian Institute of Sciences (LIPI))

Binary Template Matching for Morphological Dilation Enhancement in Navigation Radar Imaging

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Radar imaging system is strongly influenced by other supporting systems. There is a motor system that provides angular information to the display system, and Digital Signal Processing (DSP) system that provides the main information for radar imaging. The new approach, we substitute a DC

servo motor with a DC stepper motor as radar antenna rotator in our navigation radar system development. Different from the use of servo motors that can provide angle movements smoothly, the new motor system provides angle information of 0.56 degrees in every step, results in empty pixel gaps in every 0.56 degrees in radar Plan Position Indicator (PPI) image. The width of the empty pixel gaps becomes wider when the cell array of raw data is increasing regarding the image plotting process. In this paper, we proposed a new morphological dilation method to the radar raw data based on binary template matching to accommodate the various width of empty pixel gaps before the radar raw data are plotted into the radar PPI image. By this method, the morphological dilation will only be applied to the raw data that meet the same criteria as the binary template. Otherwise, the raw data will be left as they are. The result shows that there is 150.52% pixel data addition in the empty pixel gaps from the original image, and 48.44% increase of the morphological dilation without binary template matching method.

Keywords: radar imaging, raw data, binary template matching, dilation.

Bagas Mardiasyah Prakoso, Ahmad Zainudin, Prima Kristalina, Rizqi Fauzil Azhar (Department of Electronic Engineering, Politeknik Elektronika Negeri Surabaya)

Performance Evaluation of Distribution Node in Case of LEACH Implementation on WSN

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Wireless sensor networks consisting of sensor nodes can be used as an effective tool for collecting data in various situations. Nodes are usually placed randomly in an area to perform sensing and monitor various parameters related to environmental conditions in various locations. One of the major problems in wireless sensor networks is developing energy-efficient routing protocols that have a significant impact on the overall life of sensor networks so it is important to make energy savings in these limited energy sources to extend network life. This paper proposes a hardware design and Low-Energy Adaptive Clustering Hierarchy (LEACH) routing protocol configuration for power saving by utilizing cluster head selection mechanism. The cluster head selection process is performed periodically based on LEACH algorithm enables the node to have the best lifetime responsible for communication between the nodes and the server as well as the effort to save energy consumption of limited energy sources to extend network life. So that makes the process of sending information more effective and optimal. The system has been able to display data information along with the position of nodes in the web server with an average of 42 seconds of computing time in a rotation of the system so that it can be done 85 times in 1 hour. The system is able to provide real-time information with a throughput of more than 1.052 Kbps and packet loss of no more than 6.7%. In addition, energy savings can up to 6.5% of the existing energy in a lithium battery.

Keywords: WSN, LEACH, energy saving.

Rizqi Andry Ardiansyah, Edwar Yazid (Research Centre for Electrical Power and Mechatronics, Indonesian Institute of Sciences)

Rotational Speed Control of Brushless Dc Motor Using Genetic Algorithm Optimized PD Controller

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Controlling the rotational speed of brushless DC (BLDC) motor is an essential task to improve the transient and the steady state performances under loaded condition. Rotational speed control of BLDC motor using genetic algorithm optimized proportional-derivative (PD) controller to form what the so-called the genetic algorithm-PD (GA-PD) controller is proposed in this paper. Control system is realized in a microcontroller namely a 16MHz Atmega 2560 with an absolute encoder as a position sensor. The effectiveness of the GA-PD controller is tested under constant and varying step functions with the Ziegler-Nichols-PD (ZN-PD) controller as a benchmark. Experimental results show that the GA-PD controller has slower speed than the ZN-PD controller, but the latter has overshoot and small oscillations during its steady state condition as a consequent of having a fast rise time.

Keywords: rotational speed; BLDC motor; PD controller; genetic algorithm.

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The Editors 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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