



SCIENTIFIC CONFERENCE OF ELECTRICAL ENGINEERING

# THIRD SCIENTIFIC CONFERENCE OF ELECTRICAL ENGINEERING

Sponsored by IEEE IRAQ Section

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# BOOK OF ABSTRACTS



## *Welcome Messages*

### Welcome to SCEE 2018

Welcome to the Third Conference of Electrical Engineering 2018 (SCEE2018). The conference is technically sponsored by IEEE which is represented by IEEE Iraq Section. The conference is jointly organized by Department of Electrical Engineering, Department of Control and Systems Engineering, Department of Computer Engineering and Department of Communication Engineering. The conference is the premier forum for presenting the new results of advanced topics in science, engineering and applications. The aim of the conference is to bring together leading academic, scholars and students, in order to discuss theoretical and practical issues through sharing their experiences and research results. Its focus is to create and distribute knowledge about the use of scientific and engineering applications.

## Welcome Message from Honorary Chairman of SCEE 2018



I would like to express my gratitude to all of you for joining us at the Third Conference of Electrical Engineering 2018 (SCEE2018). To our guests who have come from other universities, I welcome you to our conference; we indeed honored to have you here with us. In an increasingly globalized world, there is a critical need to develop and recommendations for promoting level, but beyond universities and research centers, it is equally important that the businessmen and the leaders of public and private sectors are committed to the best practices in research guidelines integrity in research at an international. Thus, I am confident that this conference will allow researchers, industry players, academicians and decision makers share their experiences and knowledge to generate innovative research with the use of modern technologies efficiently and provide solutions to various issues of governance. In addition, I encourage everyone to engage in fruitful discussions with each other and trying to establish scientific collaboration between our universities and institutions. I would like to thank the scientific and the organizing committees, and everyone involved in this event for their unlimited efforts, especially our partner organizations and companies that have contributed to the SCEE2018. Finally, I wish you a successful conference and fruitful discussion.

Prof. Dr. Amin Dawai Thamir  
Conference Chairman  
President,  
University of Technology-Iraq

## Welcome Message from the Scientific Chair of SCEE2018



First of all, I would like to thank the staff members of Department of Electrical Engineering, Department of Control and Systems Engineering, Department of Computer Engineering and Department of Communication Engineering for their excellent support and cooperation on this event. This conference is the first of its kind held at University of Technology which is technically sponsored by IEEE Iraq Section (Institute of Electrical and Electronics Engineers). The target of this event is to provide a platform for researchers, scientists, and software developers to meet and discuss on the new research and development and trends in science and engineering. The conference has attracted many professionals and researchers from universities, research centers, research institutions, and government agencies around the globe. Highly ranked papers were accepted in the conference and will be submitted to the IEEE Xplore digital library (indexed by Scopus) for publication. The main idea of this conference is to become a starting point to establish a series of conferences and involve members especially scientists and researchers to work together within the umbrella of SCEE community. My dream is to establish SCEE society and make it a worldwide society of professionals from research, applications and industry sectors. Finally, I would like to acknowledge and highly appreciate national and international scientific committee members, local organizing committee members, exhibitors and other individuals for their great contributions.

Prof. Dr. Alaa Abdulhassan Atiya  
Chairman of Scientific Committee  
Vice President for Scientific & Postgraduate Affairs,  
University of Technology-Iraq

## Welcome Message from the Chair of SCEE2018



Welcome to the Third Conference of Electrical Engineering 2018 (SCEE2018) which is sponsored technically by IEEE. We appreciate your attendance in this conference. SCEE2018 is a conference organized by; Department of Electrical Engineering, Department of Control and Systems Engineering, Department of Computer Engineering and Department of Communication Engineering. This conference aims to promote the development of new methodologies, algorithms and applications related to the representation of advanced science and engineering. SCEE2018 provided a great opportunity to the researchers from all over the world to get involved and publish their work with the IEEE Conference Proceedings. It is my hope, that this conference will benefit all participants and will promote research to open new gate of collaboration. I would like to thank IEEE Iraq branch and all contributors of the conference including all authors, organizing committee, editorial review board members, session chairs, all presenters, our financial sponsors for making SCEE2018 an excellent conference. I cordially wish that this conference would be fruitful for all of you.

Asst. Prof. Dr. Dhari Yousif Mahmood  
Chairman of Organizing Committee  
Department of Electrical Engineering,  
University of Technology-Iraq

## Welcome Message from IEEE Iraq Section



It is my pleasure to be a part of this scientific event and be one of the stones who tries to raise the scientific level in the whole Iraq. We are, as IEEE Iraq section, confident that such technical sponsoring of international conferences will provide good opportunities to the researchers, industry players, and decision makers to share their experiences and knowledge. Ultimately, it will provide suitable solutions to various issues which need a good scientific cooperation among the different research disciplines. This conference was organized through collaboration among many parties; Department of Electrical Engineering, Department of Control and Systems Engineering, Department of Computer Engineering, Department of Communication Engineering and IEEE Iraq Section, as the scientific sponsorship of this event is authorized by the IEEE Organization. These parties worked hard to gain good scientific outputs which will inform the world that Iraq has a good scientific mind, and capable to produce such excellent scientific outputs. Finally, we would like to thank the scientific and organizing committees, and everyone involved in this event, especially authors, for their unlimited efforts. We also would like to take the advantage of the opportunity to express my gratitude to all national and international reviewers. Without their scientific supports, such scientific event would not be achieved.

Prof. Dr. Sattar B. Sadkhhan  
Representative,  
IEEE Iraq Section



## Welcome Message from Secretariat of SCEE2018

It was a difficult task for us to be a secretariat of the conference. However, we are extremely happy to get reach to this point and having such a nice conference output. Therefore, we take the advantage of this opportunity to thank the Department of Electrical Engineering, Department of Control and Systems Engineering, Department of Computer Engineering and Department of Communication Engineering and IEEE Iraq section for this trust. We would like to thank all the participants (authors, reviewers, and attendees) for their patient since announcing the conference till today. Finally, it is our pleasure to welcome all of you in this scientific event and get to know each other.

Asst. Prof. Dr. Ivan A. Hashim  
Secretariat,  
University of Technology-Iraq

Dr. Ahmed S. Ezzulddin  
Secretariat,  
University of Technology-Iraq

## Maximum Power Point Tracking Photovoltaic Fed Pumping System Based on PI Controller

**Hanan Mikhael D. Habbi**

Electrical Engineering Department  
University of Baghdad, Iraq  
hhabbi@gmail.com

**Ahmed M. Abdul Hussain**

Electrical Engineering Department  
University of Baghdad, Iraq  
ahmedaladely87@gmail.com

### Abstract:

This paper presents a PI controller for DC voltage of a voltage source inverter that drives a BLDC motor based on a solar photovoltaic (SPV). Practically, this system is applied to a water pumping system. To consider the variation of the climate conditions, a maximum power point tracking MPPT technique used with PV solar systems to maximize power extraction. Moreover, the improvement of the solar panel efficiency is investigated by using perturb and observe maximum power point tracking (PO-MPPT) technique. A PI controller is used to improve the performance of dynamic BLDC responses. The operation of this technique is utilized to generate the duty ratio of MPP and tracks the solar PV panel. The PI controller is used to validate the speed of a BLDC motor by regulating the VSI input voltage. The model of the proposed system is developed in the Matlab / Simulink. The simulation results are demonstrated a suitable performance in various dynamic operating conditions.

**Keywords** – PV panel; Boost converter; Maximum power point tracking (MPPT); Voltage source inverter; BLDC motor.



## Numerical Study and Design of an Impressed Current Cathodic Protection System for Buried Pipes

**Saif aldeen H. Mohammed**

College of Engineering  
Al-Mustansiriyah University, Iraq  
saifyouf@yahoo.com

**Isam M. Abdulbaqi**

College of Engineering  
Al-Mustansiriyah University, Iraq  
embaki56@yahoo.com

### Abstract:

In this work, the idea of the impressed current cathodic protection CP method for metallic buried pipes is declared; then, the available theoretical background of the design of such a system is studied. Since all the available formulas of the CP system design are empirical and approximate, the numerical approach is considered using the Finite Element Method (FEM) to reach the more accurate description of the system behavior. The already existing cathodic protection CP system of the pipe used to transfer raw water from the Tigris River to Al-Quds Gas Station in Baghdad is considered as a case study. Using FE computer package ANSYS for this purpose suffers from meshing the model. A small-scale model of the system is considered to describe the operation and declare the analysis. A modified approach is suggested for designing such a system and achieves more accurate protection practically. A suggestion to improve the CP system of Al-Quds Gas Station is mentioned.

**Keywords** – Cathodic protection; Corrosion; Impressed current; Finite Element Method; reference electrode (CU-CUSO<sub>4</sub>).

## Damping Improvement by Using Optimal Coordinated Design Based on PSS and TCSC Device

**Shaymaa H. Shri**

Department of Electrical Power Engineering  
Techniques  
Electrical Engineering Technical College  
Middle Technical University, Iraq  
shame\_ll@yahoo.com

**Ali N. Hussain**

Department of Electrical Power Engineering  
Techniques  
Electrical Engineering Technical College  
Middle Technical University, Iraq  
alinasser1974@yahoo.com

### Abstract:

This paper presents new design procedures for the simultaneous coordinated design of Power System Stabilizer (PSS) and a Thyristor Controlled Series Capacitor that provided with Power Oscillation Damping Controller (TCSC-POD) in a Single Machine Infinite Bus (SMIB) power system. The coordinated designs problem between PSS and TCSC-POD controller over a wide range for different loading conditions were converted to an optimization problem with the time domain-based objective function, which is solved by a Dolphin Echolocation Optimization (DEO) technique that has a strong ability to find most optimistic results. The DEO has a few parameters easy to be set and leads to excellent results with low computational efforts. The results of this study show that proposed coordinated controller has reduced system response in terms of overshoot, settling time and confirmed the excellent capability of a proposed method in getting the satisfactory damping performance and enhance the dynamic stability of power system greatly. Moreover, the results revealed that the coordinated, designed stabilizer demonstrates its superiority over their individual controllers PSS and TCSC-POD for improving damping characteristics of a SMIB power system at different loading conditions.

**Keywords** – Low Frequency Oscillation; PSS; TCSC; Damping Power Controller; Dolphin Echolocation Optimization Algorithm.

## Modified Local Search Particle Swarm Optimization Algorithm Based On Channel Estimation With VHDL

**Ansam S. Jabbar**

Department of Electrical Engineering,  
University of Technology, Iraq  
ansamsubhi2015@gmail.com

**Ali K. Nahar**

Department of Electrical Engineering,  
University of Technology, Iraq  
30081@uotechnology.edu.iq

**Hussain K. Khleaf**

Department of Electrical Engineering,  
University of Technology, Iraq  
eng\_h\_k\_msc@yahoo.Com

**Mohammed J. Mortada**

Ministry of Electricity, Iraq  
Mohammed.jawad@codeforiraq.org

### Abstract:

In this paper, a physical layer prototype is designed for 4G communications system which is designed on the basis of Orthogonal Frequency Division Multiplexing (OFDM) modem. The new Channel Rating Scheme was named "Improved Particle Squadron Local Search Analyzer" (MLS-PSO). Then, the implementation of the technique XILINX Virtex-7 by Field Programmable Gate Array (FPGA) and compared to the other Virtex type device. The damaged signal may be improved using system modulation and de-modulation technique through the advancement of the proposed method. When those variations are considerable over the data frame duration, developing precise channel estimators that are able to track the variations of a channel is specifically important for the reduction of the training signaling that is required for adaptation of parameters. The suggested model is designed with the use of VHDL and verified for being functional in Model-Sim and implemented targeting Virtex-5 enhancement kit. The projected frequency of operation of the design is 102.097MHz; the area is 15% of the entire available area and the whole power of 0.314 W, which leads to better results model according to the area, power, and speed performance.

**Keywords** – Channel Estimation; LSPSO; OFDM; VHDL.



## Optimal Hybridisation Of a Renewable System to Fulfill Residential Electrical Load: In Mosul, Iraq

**Omar H. Mohammed**

Technical College of Mosul, Northern Technical University, Iraq  
omar.hazem@ntu.edu.iq

### Abstract:

This paper proposes a hybrid power system model (HPS) includes hydropower turbines, photovoltaic panels, and battery bank to satisfy an off-grid residential electrical load in Mosul, Iraq, with daily energy consumption about 8000kWh/day for peak power demand about 1MW and over a lifetime about 25 years. The proposed model was analyzed and carried out using HOMER Pro simulation that gives an economical integrating of the hybrid power system with high-reliability, optimal cost of energy production and reducing emissions. The results show that the proposed model of the hybrid renewable energy system that consists of hydropower turbines, photovoltaic panels, and battery bank provides a feasible strategy to meet the annual electrical demand for off-grid sites in Mosul. As well as, it ensures and improves the reliability of integration of the hybrid power system sources to minimize the total net present and energy cost of the system, with high efficiency under different climatic conditions. This work could be considered the art of the review to encourage researchers to exploit the renewable energies available in Iraq, especially with regard to the exploitation of solar and river energy in generating electricity.

**Keywords** – Renewable energy; Hybrid power system; Hydropower; solar pan; Homer Pro.

## Shunt Active Power Filter System Design for Harmonic Suppression via Wavelet Transform

**Ekhlas M. Thajeel**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
ekhlasmhawi@gmail.com

**Mazin M. Mahdi**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
mazin.mustafa25@yahoo.com

**Hamdan Daniyal**

UMP, malaysia  
hamdan@ump.edu.my

### Abstract:

One of the serious problems with modern electrical loads is harmonics, which is generated from nonlinear loads. Harmonics can lead to excessive heat and noise in the loads and create a large amount of energy losses either in transmission systems or distribution systems. Compensation of these harmonics substantially improves the power factor and reduces the total harmonic distortion index (THD). This means that the system can transfer more active power without having to increase the capacity. Traditionally, passive filters have been used to remove harmonics, but for their intrinsic downsides, they have been replaced by active power filter (APF). APF has superior filtering characteristics and dynamic response compared to passive filters. Synchronous Reference Frame (SRF) has been widely adopted for harmonics extraction in APF, although it has been found out to have a slow response. Discrete Wavelet Transform (DWT) on the other hand, is a good candidate for harmonics extraction. The new controller is thoroughly developed and rigorously simulated in the MATLAB-Simulink environment. The harmonics source is a 5.5 kW nonlinear load mimicking a real-life load from previous practical studies. In conclusion, DWT is a better candidate for harmonics extraction in APF, as compared with SRF.

**Keywords** – Active Power filter; Total Harmonic Distortion; Synchronous Reference Frame; Discrete Wavelet Transform.

## Load Frequency Control for Hybrid Micro-grid Using MRAC with ANN under sudden Load Changes

**Mazin M. Mahdi**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
mazin.mustafa25@yahoo.com

**Ekhlas M. Thajeel**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
ekhlasmhawi@gmail.com

**Abu Zaharin Ahmad**

University Malaysia Pahang,  
Malaysia  
zaharin@ump.edu.my

### Abstract:

The frequency and power generation control in a power system is usually referred to as a load frequency control. This paper focuses on two control schemes based on an adaptive controller to track sudden load increase and smooth the transfer from grid-connected to island mode and improving the performance of hybrid micro-grid. One scheme uses a model reference adaptive controller (MRAC) to develop the LFC of a synchronous generator based on adaptive proportional-integral (API) controller and to smooth the transfer from grid-connected to island mode. The other scheme employs an MRAC with a Neural Network to further modify the reduction of the error signal in the classic MRAC controller and cover any fluctuations in frequency at power-sharing during sudden changes in the load. The estimated parameters are used to update the gains of conventional MRAC controller to obtain the best control performance of the micro-grid. The proposed controller is validated by computer simulation analysis using MATLAB-Simulink.

**Keywords** – Load Frequency Control; Model Reference Adaptive Control; Neural Networks.



## Modified Application of Phasor Measurement Unit in Voltage Monitoring of Power System

**Tara Alzahawi**

Electrical Engineering, March Consulting, Canada  
tara.alzahawi@usask.ca

### Abstract:

Application of Phasor Measurements Unit (PMU) in system monitoring and control has been receiving enormous attention in the power system industry nowadays. The availability of real-time synchronized phasor measurements offers unparalleled opportunities to expand the visibility of control centers and improve system reliability utilities have taken important steps to incorporate PMU s into the key and critical load centers, and the output of the PMUs are used as an input parameter to special voltage protection and control schemes. The focus of this paper is on the recent work accomplished in the area of voltage monitoring and control by utilization of synchronized measurements received from PMU on the heavily loaded and critical bus.

**Keywords** – PMU; Monitoring and control; State estimation; Instability; Voltage monitoring.

## A new Supervisory Strategy of A modified D-STATCOM with Dual DC Source in Smart Distribution Grids

**Shatha S. Al-kubragyi**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
shatha\_suhbet@yahoo.com

**Patrick C.K. Luk**

Collage of Engineering,  
Cranfield University, UK  
p.c.k.luk@cranfield.ac.uk

**John Economou**

Collage of Engineering,  
Cranfield University, UK  
j.t.economou@cranfield.ac.uk

### Abstract:

This study presents a novel approach in applying a fuzzy logic controller-based decision making for power management of the modified D-STATCOM converter supplied by a dual DC source (battery and supercapacitor) to achieve a robust and superior performance for voltage regulation. Conventional D-STATCOM is a compensator-based power electronic device, employed as a reactive power source in AC power systems to maintain voltage stability. However, these devices have limited ability to mitigate voltage fluctuations caused by active power disturbances. To fully exploit the potential of the D-STATCOM device, energy storage technology has been combined with D-STATCOM to support the grid with reactive and active power in the microgrid. The proposed approach employs the advantage of high-power storage unit (supercapacitor) and high energy storage unit (battery) with a D-STATCOM configuration to avoid the limitations of using only one specific storage unit. Furthermore, the fuzzy logic management approach distributes the power required almost instantaneously between the energy sources. Thus, it is possible to implement an intelligent real-time energy management controller able to effectively distribute the required current from the HESS and provide good performance of the voltage at the PCC. Verification of the control designs has been achieved through simulation using MATLAB/SIMULINK based on the derived analytical model in state-space form. Comprehensive simulation results show that the modified D-STATCOM topology-based HESS with a proposed fuzzy controller demonstrates significant improvements over conventional D-STATCOM controllers in supporting voltage stability under different conditions in distribution networks.

**Keywords** – Voltage stability; D-STATCOM; Fuzzy logic; Smart Grids.



## Buck-Boost In-Out of Phase Y-source AC Matrix Converter

**Kadhim M. Kadhim**

Department of Electrical Engineering,  
University of Technology, Iraq  
kadhim.alhakeem@gmail.com

**Oday A. Ahmed**

Department of Electrical Engineering,  
University of Technology, Iraq  
30205@uotechnology.edu.iq

### Abstract:

A new class of buck-boost AC/AC single-phase Y-source matrix converter is presented in this paper. The proposed AC/AC matrix configuration has the ability to boost the output voltage in out-of-phase/in-phase in related to the input voltage. Also, it can be bucked the output voltage with respect to the input voltage with out-of-phase/in-phase of input and output voltages. For eliminating the voltage overshoots on the converter power switches without the need of using the snubber circuit, a safe-commutation technique is applied to the proposed converter to create a path for the current to flow continuously. The details analysis and the operating principles have been introduced for the proposed AC/AC single-phase Y-source matrix converter. To evaluate the performance of the converter, a co-simulation using OrCAD/PSpice and Matlab/Simulink has been developed. The simulation shows that the voltage at the output can be boosted or bucked by varying the duty cycle, while the output voltage can be out-of-phase/in-phase with respect to the input voltage by changing the PWM strategy.

**Keywords** – Matrix converter; Y-source; Safe commutation; Solid state transformer.

## Power Factor Analysis of High-Frequency Transformer Based DC-DC Bidirectional Dual Active Bridge

**Hussain K. Sayed**

Department of Electrical Engineering,  
University of Technology, Iraq  
hksayed@uolr.edu

**Wijdan H. Muttalak**

Laser and Opto-Electronics Engineering,  
University of Technology, Iraq  
140109@uotechnology.edu.iq

### Abstract:

This paper presents a power factor analysis of high-frequency transformer (HF) in the DC-DC bidirectional dual active bridge (BDAB). The power factor is analyzed based on using three modulation techniques: conventional phase shift modulation (PSM), triangular current modulation (TriCM), and trapezoidal current modulation (TrpCM) method. The analysis shows that the HF transformer suffers from poor power factor using PSM compared to both TriCM and TrpCM modulation techniques. Poor power factor is another meaning for low efficiency and high power loss. On the other side, the voltage operation range of the converter is limited under both TriCM and TrpCM switching control methods. To extend the operating voltage range and achieving high power factor condition, combining both triangular and trapezoidal modulation methods is considered and analyzed in this research. The power factor is significantly improved as both TriCM and TrpCM techniques under are combined. A deep mathematical representation for the HF transformer power factor, current, and transferred power are presented under each modulation technique. Matlab simulation tools are used to analyze and verify the derived power factor equations.

**Keywords** – DC-DC dual active bridge; Bidirectional transferred power; Power factor; High-frequency transformer.

## A 3D FEA Approach to Design an Induction Coil for Case Hardening of a Carbon Steel Gear

**Hamdan F. Sabeeh**

Electrical Eng. Dept.  
Al-Mustansiriyah University,  
Iraq  
Hamdan.alramahe@yahoo.com

**Isam M. Abdulbaqi**

Electrical Eng. Dept.  
Al-Mustansiriyah University,  
Iraq  
embaki56@uomustansiriyah.edu.iq

**Sahib M. Mahdi**

Material Eng. Dept.  
Al-Mustansiriyah University,  
Iraq  
saheb.m.mahdi@uomustansiriyah.edu.iq

### Abstract:

It is already known that the external surface of the gear must be hardened to a certain depth to achieve a better mechanical performance. This work deals with the determination of the suitable induction coil parameters leads to make it able to generate the required temperature distribution in the gear body during the induction hardening process within the required time. These parameters are; the geometry of the coil, its number of turns, and both the magnitude and the frequency of the current passing through the coil during the heating process. Also, the work deals with the determination of the required period of time elapsed during the quenching process to reach the required case hardening of the carbon steel CK-45 gear. For this purpose, the ferrite flux concentrator option is proposed and studied in this work. The effect of two kinds of ferrite materials has been analyzed in this paper. In this research, a 3D electromagnetic-thermal coupled Finite Element Method (FEM) analysis adopted using the ANSYS computer package. The proposed designs with and without the flux concentrators results are shown and a declaration of the differences between the two types of different aspects.

**Keywords** – Flux concentrator; Surface hardening; Induction heating; Coil parameters; FEM.

## Robust Eye Features Extraction Based on Eye Angles For Efficient Gaze Classification System

**Noor H. Jabber**

Department of Electrical Engineering,  
University of Technology, Iraq  
rosemax1880@gmail.com

**Ivan A. Hashim**

Department of Electrical Engineering,  
University of Technology, Iraq  
30095@uotechnology.edu.iq

### Abstract:

Detection of eye gaze direction is a hot topic for research in the computer vision area which can be used in many applications. Although the researchers have presented significant eye tracking techniques for the last years, it is still the challenging task for improving the performance of gaze detection system. This paper presents a new eye feature extraction system to build a robust eye gaze classifier which uses the Viola-Jones algorithm to face detection and Constrained Local Neural Field model for eye region localization. Furthermore, geometry features of the eye are extracted from the detected eye region based on angles of a triangle of the eye. The algorithms were tested by a new dataset created from 34 participant females and males in the different ages. The experimental results show that this method has better features extraction for the classification process.

**Keywords** – Eye gaze recognition; Eye gaze feature extraction; Eye localization.

## Digital Image Scrambling Using Chaotic Systems Based On FPGA

**Atheer J.Mansoor**

Al-Turath University, Iraq  
screem\_man2@yahoo.com

**Hikmat N. Abdullah**

college of Information  
Engineering, Al-Nahrain  
university, Iraq  
hikmat\_04@yahoo.com

**Hadi T. Ziboon**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
haditarishziboon@yahoo.co.uk

### Abstract:

Image scrambling is one of the encryption techniques which is used to change the pixels' position instead of changing pixels' values. In this paper, an implementation of image scrambling by using chaotic flow sequences in FPGA is presented. The proposed system depends on transforming the image dimension into vectors then the chaotic system is implemented on the transformed image to produce the scrambled image using FPGA kit. FPGA Spartan-3A DSP 3400A hardware platform is used for the proposed system, where the testing image is in size  $20 \times 20$  RGB digital image. The proposed system is the first image scrambled system could be implemented in FPGA.

**Keywords** – Image encryption; Cryptography; Image scrambling; Chaotic systems.

## Hardware Implementation of Heart Disease Diagnosis System Based on NVG-RAM Classifier

**Tabreer Tareq**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
tabo.tariq@gmail.com

**Manal H. Jasim**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30048@uotechnology.edu.iq

**Ivan A. Hashim**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30095@uotechnology.edu.iq

### Abstract:

This paper presents a diagnosis system design used to assist the physicians to diagnose the heart condition by converting medical factors of the patients into a numerical representation. The proposed heart disease diagnosis system can classify two heart conditions (normal and abnormal). Also, it can classify four abnormality heart conditions in addition to the normal case. Two types of database are used in the classification process: the online database from The University of California, Irvine (UCI) machine learning dataset repository and collected real database (CD). These databases consist of 13 medical factors that are successful in diagnosing heart disease. The simulation results show that the proposed Numeral Virtual Generalizing Random Access Memory (NVG-RAM) Weightless Neural Network classifier had 100% accuracy of two heart diseases classification when the performance of this classifier was evaluated using CD. Additionally, this classifier achieves 90% success rate when recognizing 5 states for the same database. According to the UCI database the NVG-RAM is considered best classifier for classifying two types of heart disease based on a different division of training and testing database. Furthermore, the diagnosis accuracy for classify five types is 71.698%. The proposed Heart disease classifier is hardware implemented using FPGA platform kit (Spartan-3A DSP 3400A). This classifier achieves high success rate when tested in using CD for diagnosis two-class heart disease that gives maximum accuracy 100%. Moreover, the NVG-RAM is considered as a good algorithm for diagnosis multiclass heart diseases that gives maximum accuracy of 88%.

**Keywords** – Diagnosis system; Heart disease; NVG-RAM.

## High-Resolution Systems for Automated Diagnosis of Hepatitis

**Hadeel N. Abdullah**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30002@uotechnology.edu.iq

**Bassam H. Abd**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
bassamh2014@yahoo.com

**Sara H. Muhi**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
eng.sara.muhi@gmail.com

### Abstract:

This study aims to optimize the accuracy of diseases diagnosis, where many studies have been conducted to challenge the highest diagnostic accuracy of hepatitis disease because the early and correct diagnosis increases the chance of saving the patient's life from this deadly disease. Therefore, in this paper, we have done a good test for three classifications, namely: support vector machine (SVM), multilayer perceptron (MLP) and K-nearest neighbor (KNN). The accuracy of the KNN overcome the rest of the classifier with 100% accuracy for the diagnosis of hepatitis disease. We used the same division of data used in previous works for a fair comparison using the datasets gotten from UCI machine learning database, with 19 features. This result is the best yet.

**Keywords** – Hepatitis diagnosis; Medical Expert System; K-nearest neighbor; multilayer perceptron; support vector machine.

## Detection of Deception Using Facial Expressions Based on Different Classification Algorithms

**Harith H.Thannoon**

College of Engineering,  
Ninevah University, Iraq  
30036@uotechnology.edu.iq

**Wisam H. Ali**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30088@uotechnology.edu.iq

**Ivan A. Hashim**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30095@uotechnology.edu.iq

### Abstract:

Most psychologists argue that facial behavioral during lying is different from facial behavioral when telling the truth, so the facial behavioral can be used as reliable indicators for spotting liars. The deception detection systems (DDSs) based on facial expressions are non-invasive, mobile and cost-effective. In this work a DDS is depended on Facial Action Coding System (FACS) for facial features extraction, the main idea of FACS is to describe all facial actions using Action Units (AUs), each AU is related to movement one or more facial muscles. Eight AUs are used which incorporated into a single facial behavior pattern vector; these AUs are AUs 5, 6, 7, 10, 12, 14, 23, and 28. Datasets are collected for 43 subjects (20males, 23 females) most of them between ages 18-25. Four types of classification algorithms are used individually in the last stage of the proposed system; these classifiers are MLP, KNN, VG-RAM, and SVM. The simulation results show that the best results are obtaining when using VG-RAM and KNN classifiers. The main contributions of this work are new classification techniques in DDS, collect real database that can be used to measure the performance of any DDS based on facial expressions, and select suitable facial features.

**Keywords** – Deception detection; FACE; VG-RAM; KNN; MLP.



## A New Technique for the Characterization and Design of Class-F RF Power Amplifiers

**Firas M. Ali**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30204@uotechnology.edu.  
iq

**Mahmuod H. AL-Muifraje**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30207@uotechnology.edu.iq

**Thamir R. Saeed**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
thamir\_rashed@yahoo.co  
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### Abstract:

In class-F RF power amplifiers, there are several methodologies used to characterize the RF power device in order to present the proper harmonic impedances at its terminals, the most widely used of which is the load-pull method. This paper presents an alternative technique based on the analytic derivation of the optimum terminal load impedances at the first three harmonic frequencies using both the device intrinsic and package parasitic elements. The output matching network is then synthesized analytically to present the calculated harmonic impedances at the device output terminal. As a confirmation to the proposed technique, a 6-W power amplifier circuit has been designed and simulated using a commercial GaN HEMT power device to operate at 900 MHz. The simulated results show a drain efficiency of more than 84%, output power of more than 38 dBm, and power gain of more than 13 dB at the specified frequency.

**Keywords** – Class-F; RF Power Amplifier; GaN HEMT.

## Design and Implementation of a Spoken Letter recognition system to control the Upper Prosthetics

**Jabbar S. Hussein**

Collage of Engineering  
University of Kerbala  
jabbar.salman@uokerbala.  
edu.iq

**Alaa H. Ali**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
140007@uotechnology.  
edu.iq

**Thamir R. Saeed**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
thamir\_rashed@yahoo.  
com

### Abstract:

The humanoid robot represents a promising application in the medical, handicapped and industrial limbs fields. The control of the hand fingers of the spoken command is one of the importance of these applications. This paper presents the proposed design of the hand-fingers controls circuit through the spoken letter. This design is based on the control of servo motors for each finger by Arduino controller. The Arduino has received a coded signal from the recognition algorithm to give the signals with different' duration to the servo motors to take the required hand-fingers form which is corresponding to the spoken letters. These codes relate to the statistical features of that letter, which are extracted from the spoken signals. Then, by using the Multilayer Feed-Forward Neural Network algorithm as a classifier, the simulation recognition, which has been gained is 96.33% while the experimental recognition is 94.8 %. The difference between these results is caused by the reject some patterns caused by the motor's errors.

**Keywords** – Artificial Limbs; Pattern Recognition; Neural Network.

## EMG Signal Classification using Radial Basis Function Neural Network

**Ahmed M. AlKhazzar**

College of Engineering  
University of Kerbala, Iraq  
ahmed.m.ahmed@uokerbala.edu.iq

**Mithaq N. Raheema**

College of Engineering  
University of Kerbala, Iraq  
methaq.n.rhama@uokerbala.edu.iq

### Abstract:

Classification of electromyography(EMG) signals of human arm using Radial Basis Function Neural Network (RBFNN) is presented. Using an 8-channel Myo armband, EMG signals are collected from the arm muscles. Several time domain features are extracted from the collected EMG signals; then an RBFNN is trained. In the training process, the patient moves his\her hand according to a predefined position to obtain training patterns. After the training process is completed, the trained RBFNN can recognize the patient's intended gesture from the hand's EMG signals and consequently the patient is able to control a prosthetic hand's movements. One RBF network is trained for each extracted feature, and excellent classification results are achieved. Next, different structures of RBFNN are implemented to obtain a simpler classifier. A MATLAB program is written to train networks and record the results. The experimental results show that RBFNN is an excellent classifier with RMS error less than or equal to 10-15 for implementing a myoelectric prosthetic hand.

**Keywords** – EMG Signal Classification; Radial Basis Function Neural Network; RBFNN; Myoelectric Prosthetic; Electromyography.

## FPGA Cyclone II based the Mobile Robot Control System

**Reem I Mohammed**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
gardnie91@yahoo.com

**Saad M Abbas**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
saad\_ra25@yahoo.com

**Abbas H. Issa**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30050@uotechnology.edu.iq

### Abstract:

Mobile robots are expected to be used in harsh and non-organized environments. Such as the applications that robots need to Collection of information from complex conditions for their functioning which have become very common, especially in places that are hard to reach by humans. The wireless capability, avoid obstacles and speed/position controllers have taken great interest in the design of mobile robots because of the extensive use in industrial and service fields. Therefore, the realization of efficient and robust robot system still challenging task. This paper presents a mobile robot with Artificial Neural Network (ANN) controller implemented on Altera FPGA mini-board with wireless capability to move to a specific distance by avoiding the obstacle. This system uses Nios II/e soft-core processor instantiated in ANN control of the motors based on the data provided by the sensors. The design shows flexibility in hardware and software, where the design can be modified easily by inserting more complex function due to the capacity of FPGA in contrast to the existing microcontroller or microprocessor-based designs. In comparison with previous research, the application of robots based on the existing design is the presence of microcontroller such as Arduino with FPGA. In the research, the only FPGA offering the possibility of adding more complex functions to the ability of the robot is used.

**Keywords** – Mobile Robot; Intelligent; Controller; ANN; FPGA, Sensors.

## Next Generation UWOC System Based on MIMO and QAM-OFDM Modulation Techniques

**Alaa H. Ali**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
140007@uotechnology.edu.iq

**Shehab A. Kadhim**

Ministry of Science &  
Technology, Iraq  
shkadhim@yahoo.com

**Hasan M. Azzawi**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
eng.hasan.mahmood@gmail.com

### Abstract:

The proliferation of (UOWC) underwater optical wireless communication attributed to its higher data rates than the traditional acoustic communication systems, so it has many potential applications ranging from coastal waters to deep oceans. In this paper, the main focus is to understand the optimum system design, feasibility and the reliability of high data rate underwater optical links due to various propagation phenomena that impact the performance of the system such as channel characterization, modulation schemes and various sources of noise which are due to reflection, diffusing and absorption. Using Multi-Input-Multi-Output (MIMO) as next-generation techniques, in addition, Coherent Optical Orthogonal Frequency Division Multiplexing (CO-OFDM) with quadrature amplitude modulation (QAM) aims to provide the development of new ideas that would help in the growth of future underwater communication, which doable to cut back the consequences of underwater attenuation disturbances. Also, different configurations of MIMO with a CO-OFDM technique are proposed and simulated. The system performance has been evaluated for high turbulence underwater channel. The performance analysis of underwater wireless optical communications using OFDM and MIMO technique are analyzed, and performance comparison between these schemes has been done taking many parameters into thought using (OptiSystem) software.

**Keywords** – Underwater optical wireless communication (UOWC); MIMO; OFDM.

## FPGA Implementation of Single Neuron PID Controller for Depth of Anesthesia Based on PSO

**Layla H. Abood**

Control & System  
Engineering, University of  
Technology, Iraq  
60066@uotechnology.edu.iq

**Ekhlas H. Karam**

College of Engineering,  
University of Al  
Mustansiriya, Iraq  
ek\_karam@yahoo.com

**Abbas H. Issa**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30050@uotechnology.edu.iq

### Abstract:

Anesthesia is considered as one of the most important parts of any surgical operation due to this it must be good monitored and controlled, i.e., the rate of infusion must be given an inappropriate dose to save the patient status in an adequate level of anesthesia. The model translates the relationship between the drug used and patient response is pharmacokinetic-pharmacodynamic (PK/PD). Bispectral index (BIS) is the best standard for monitoring the depth of Anesthesia. In this paper an optimal design of a self-tune single neuron PID controller with exact linearization strategy is presented to evaluate the drug infusion, the input to closed-loop controlled system is the propofol and one the output is the Bispectral index (BIS) reading for the patient during the surgery. The optimal controller will calculate the infusion rate by using particle swarm optimization (PSO) method for tuning all the variables needed to find the optimal rate and considered it as a control signal, then implement it on FPGA Spartan Kit XC3SD3400ACS484-4 by using Xilinx development tool (ISE 14.6). The Simulation results show the efficiency of the suggested control scheme in tracking the desired BIS for all patients' cases.

**Keywords** – Particle Swarm Optimization; PID controller; PK/PD model; Bispectral Index (BIS); FPGA.

## Utilizing Frequency Changing in Communication Systems to Reduce Power in CRC Circuits

**Qusay F. Hasan**

Control and Systems Engineering  
Department  
University of Technology, Iraq  
60022@uotechnology.edu.iq

**Omar Y. K. Alani**

Omar Y. K. Alani  
School of Computing, Science, and  
Engineering  
University of Salford, Uk  
o.y.k.alani@salford.ac.uk

### Abstract:

Modern communication circuits use adaptive modulation techniques to fulfill its task. These techniques require changing the clock frequency of the of the communication units inside the communication circuit. The clock frequency can affect the power consumption of the digital circuits. In this paper, Dynamic Voltage / Frequency Scheduling (DVFS) is modified to use the clock frequency variation so that the power of a CRC stage is reduced. The DVFS is represented by a fuzzy controller that uses the frequency and the calculated power of the system as its input to produce the required supply voltage to the CRC unite. The simulations show that for a 16bit CRC circuit a reduction in power in low frequencies can reach 75 % and the reduction is 8% in high frequencies.

**Keywords** – Communication Systems; CRC; Fuzzy Logic; Power Management.

## An Efficient Feature Extraction of Isolated Word For Dynamic Sign Language Classification

**Hussein A. Aldelfy**

College of Engineering  
University of Al-  
Mustansiriyah, Iraq  
hussienaldelfy@gmail.com

**Mahmuod H. AL-Muifraje**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
30207@uotechnology.edu.iq

**Thamir R. Saeed**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
thamir\_rashed@yahoo.com

### Abstract:

In image processing, feature extraction acts a key role. It is very imperative to know and extract the required features for further assessment. In this paper, feature extraction of Arabic isolated sign language word based on chain code model is proposed. The features are extracted from the hand trajectory tracking, features obtained of the single hand or two hand that enters to a classifier which it can determine the meaning of the gesture. In this study, More than forty isolated sign words are collected in collaboration with the Iraqi Ministry of Labor and Social Affairs. Four isolated words were taken as examples. The features were extracted from the isolated words; these features represent the feature vector of the isolated word that is used in the classification stage.

**Keywords** – Feature Extraction; chain code; Dynamic sign language.



## PI Like Interval Type-2 Fuzzy Logic Control Based Social Spider Optimization for distillation column

**Mohammed Y. Hassan**

Control and Systems Engineering  
Department, University of Technology, Iraq  
myhazawy@yahoo.com

**Sebal S. Ezzulddin**

Control and Systems Engineering  
Department, University of Technology, Iraq  
sibel.93@yahoo.com

### Abstract:

In this paper, an intelligent control using Mamdani type PI Like Interval Type-2 Fuzzy Logic Controller based Social Spider Optimization (SSO) algorithm (IT2PIFLC-SSO) is designed. This controller is used to control a binary trays distillation column. Two models of SIMO and MIMO are used. Gains of the controllers are tuned using SSO algorithm where the reflux flow rate and vapor flow rate are manipulated as variables to reach maximum purity for overhead product and minimum impurity for a bottom product with minimum overshoot, minimum settling time and minimum error. The controlled signal is the molar fraction of distillate and bottom. Integral Time Absolute Error (ITAE) is employed as an objective function to measure the improvement in time. Simulation results have shown that the proposed IT2FLC-SSO works efficiently with no disturbance and with the effect of disturbance.

**Keywords** – Distillation; Fuzzy Logic Controller (FLC); Interval Type-2 (IT2); Social Spider Optimization (SSO).

## Development of a Path Planning Algorithms and Controller Design for Mobile Robot

**Ahmed S. Al-Araji**

Computer Engineering  
Department, University of  
Technology, Iraq  
ahmedalaraji76@gmail.com

**Attarid K. Ahmed**

Control and Systems  
Engineering Department,  
University of Technology,  
Iraq  
attarid.kudhair@gmail.com

**Mohammed K. Hamzah**

Control and Systems  
Engineering Department,  
University of Technology, Iraq  
60115@uotechnology.edu.iq

### Abstract:

This paper presents the two different types of the collision-free path planning algorithms, and a nonlinear Multi-Input Multi-Output (MIMO) Proportion Integral Derivative (PID) Modified Elman Neural Network (MENN) controller design for the mobile robot. The two proposed algorithms are Circular Road Map (CRM) algorithm as a classical method and Particle Swarm Optimization (PSO) algorithm as an intelligent method in order to avoid the obstacles and determine the target point. The proposed nonlinear MIMO-PID-MENN controller is designed to guide the mobile robot during the continuous path-tracking through static obstacles navigation with the intelligent on-line algorithm (PSO) is used to find and tune the variable control gains of the proposed controller to obtain the near optimal torques actions for the mobile robot platform. The numerical MATLAB simulation results show that the proposed algorithms have high accuracy for planning the desired path equation and generating a perfect torque action in terms of avoiding the static obstacles with a smooth and short distance and minimizing the on-line performance index value as well as a minimum number of iterations.

**Keywords** – Path Planning Algorithms; Neural PID Controller; PSO Algorithm; Mobile Robot.

## An Intelligent Cognitive System Design for Mobile Robot based on Optimization Algorithm

**Ahmed S. Al-Araji**

Computer Engineering  
Department, University of  
Technology, Iraq  
ahmedalaraji76@gmail.com

**Khulood E. Dagher**

Al-Khwarizmi Collage of  
Engineering, University of  
Baghdad, Iraq  
dagherkhulood@yahoo.com

**Bakir A. Ibraheem**

Ministry of Electricity, Iraq  
en.bakir.ali@gmail.com

### Abstract:

In this paper, a cognitive system based on nonlinear neural controller and intelligent algorithm that will guide autonomous mobile robot during continuous path-tracking and navigate over solid obstacles with avoidance. The goal of the proposed structure is to plan and track the reference path equation for the autonomous mobile robot in the mining environment to avoid the obstacles and reach to the target position by using intelligent optimization algorithms. Particle Swarm Optimization (PSO) and Artificial Bee Colony (ABC) Algorithms are used to finding the solutions of the mobile robot navigation problems in the mine by searching the optimal paths and finding the reference path equation of the optimal path. As well as, the PSO algorithm is used to find and tune on-line the neural control gains values of the nonlinear neural controller to obtain the best torques actions of the wheels for the mining autonomous mobile robot. Simulation results by MATLAB showed that the proposed cognitive system is more accurate in terms of planning reference path to avoid obstacles and online finding and tuning parameters of the controller which are generated smoothness control action without saturation state for tracking the reference path equation as well as minimize the mobile robot tracking pose error.

**Keywords** – path planning; mobile robot; neural controller; obstacles avoidance; cognitive system.

## Multivariable Extremum Seeking Control for Power Maximization and PI Tuning of Wind Turbine System

**Safanah M. Raafat**

Control and Systems Engineering  
Department, University of Technology, Iraq  
safanamr@gmail.com

**Rajaa Hussain**

Control and Systems Engineering  
Department, University of Technology, Iraq  
cse.60507@uotechnology.edu.iq

### Abstract:

Maximization of the power capture is an important issue for the turbines that are installed in low wind speed area. In order to achieve the Maximum Power Point Tracking (MPPT), a method for wind turbine operation regions 2 and 3 has been developed here based on Extremum Seeking Control (ESC) approach. The reference speed to the generator and the reference pitch angle to pitch control were generated via dither-modulation ESC scheme. In addition to using ESC for generating the desired reference trajectories, ESC is also used for tuning PI controllers in order to determine the optimal gain values that can achieve a better tracking. The purpose is to (i) ensure the stability of the system (ii) extract the maximum electrical power capture as well as reduce the mechanical loads to protect the turbine. Comparison of the performance of the system using ESC real-time optimization and Particle Swarm Optimization (PSO) has been carried out in this paper. Furthermore, in the inner control loop, the implementation of Indirect Field Orientation Control (IFOC) has been presented to decouple the currents of the generator.

**Keywords** – Extremum seeking control; indirect field orientation control; maximum power point tracking; particle swarm optimization; wind turbine.

## Intelligently Optimized Controlled Health Care System Using Brute Force and Heuristic Algorithms

**Safanah M. Raafat**

Control and Systems Engineering  
Department, University of Technology, Iraq  
safanamr@gmail.com

**Diyar J. Naji**

Control and Systems Engineering  
Department, University of Technology, Iraq  
diyar\_jalal94@yahoo.com

### Abstract:

Recently, healthcare systems have gained increased attention due to the required increase in population in societies and the need for fast action urgent cases of health. New development of technologies, internet, and IoT make further progress in the establishment of the health care system to the extent that it considered as a measure of the progress in a country. The quality of the healthcare system depends on the comfort of patients during the treatment time and monitoring. In order to achieve these goals, scientists created a remote real-time monitoring system. In this research, the data taken from simulated healthcare sensors are used in an explicit functional model called Quality of inference (QoINF) optimized within either of two algorithms. These algorithms are the intelligent Brute force and heuristic algorithms. The required task is to find the best set of sensors with high accuracy and lowest cost. Moreover, based on the value of context, the deduced best set of sensors would be examined by either heuristic rules or Fuzzy Logic Controller (FLC) to make a proper decision for the nurse or doctor that supervise the patients or elderly people.

**Keywords** – Healthcare system; sensors; Brute force algorithm; Heuristic algorithm; Remote real- time monitoring.

## Prospect Theory In Particle Swarm Optimization For Constraints Nonlinear Optimization Problems

**Ahmed I. Abdulkareem**

Control and Systems  
Engineering Department  
University of Technology, Iraq  
60162@uotechnology.edu.iq

**Hayder A. Dhahad**

Mechanical Engineering  
Department, University of  
Technology, Iraq  
10592@uotechnology.  
edu.iq

**Noor Q. Yousif**

Control and Systems  
Engineering Department  
University of Technology, Iraq  
60165@uotechnology.  
edu.iq

### Abstract:

A swarm of individuals or particles work together to achieve a collective goal are called particle swarm optimization (PSO). However, when PSO applied to Constraints non-linear optimization problems (CNOPs), this technique requires an efficient mechanism to handle the constraints, since it still suffers from the premature convergence problem (local minimum solution), and its inability to find a refinement solution, due to lack of exploitation and exploration capability. So that to deal with the above issues, a novel model of the decision-making process has been used in PSO to solve the CNOP. This decision model improves the exploration hence, reduce the risk of premature convergence, by firstly, expanding the search space through generating new alternative solutions and secondly, factoring the risk of violating system constraints during the evolutionary process; while the exploitation has been improved through taking an effective choice (less risky solution) among the generated alternative solutions. The validation of the proposed approach has been performed on four benchmarks CNOPs. The statistical results demonstrate that the new algorithm considerably better than or at least competitive to several evolutionary algorithms reported in the literature.

**Keywords** – Particle Swarm Optimization; Prospect Theory; Constraints Nonlinear Optimization Problems.

## Robot Arm Design for Children Writing Ability Enhancement using Cartesian Equations based on ANFIS

**Firas A. Raheem**

Control and Systems  
Engineering Department,  
University of Technology,  
Iraq  
60124@uotechnology.edu.iq

**Hind Z. Khaleel**

Control and Systems  
Engineering Department,  
University of Technology,  
Iraq  
60175@uotechnology.edu.iq

**Mustafa K. Khashan**

Control and Systems  
Engineering Department,  
University of Technology,  
Iraq  
sasa.sofe1992@gmail.com

### Abstract:

Writing is the main part of a children's advancement. This paper suggests a real robotic methodology for teaching children how to write and enhance their writing and drawing ability in general. This method includes design with implementation a two DOF (Degrees Of Freedom) robot arm. The robot trajectory planning motion was done using multi-segment parametric Cartesian equations based on the Adaptive Neuro-Fuzzy Inference System (ANFIS) for modeling the inverse kinematics to PWM directly. The proposed overall structure contains two ANFIS structures. The inputs of each ANFIS are the desired Cartesian coordination represents the desired letter points while the outputs are the two Pulse Width Modulation (PWM) servomotor commands needed to actuate each robot link to the desired position. The mechanical structure of the robot arm uses three servomotors. The last servomotor used for raising and lowering the pen, which is attached mechanically to the robot end-effector. In this work, the maximum position error of robot end-effector is evaluated between theoretical and experimental work. These position errors in X-axis do not exceed ( $\pm 0.0170$  m) and in Y-axis not exceed ( $\pm 0.0150$  m). The results of position errors are acceptable and occur due to the commercial servomotors used. The written letters are clear, smooth and always inside the robot reachable area.

**Keywords** – Two-link robot arm; end-effector position; ANFIS.

## Mixed H<sub>2</sub>/Sliding Mode Controller Design for Human Swing Leg System

**Mustafa J. Kadhim**

Control and Systems Engineering Department,  
University of Technology, Iraq  
cse.60034@uotechnology.edu.iq

**Hazem I. Ali**

Control and Systems Engineering  
Department, University of Technology, Iraq  
hazemcontrol2001@yahoo.com

### Abstract:

Humans walking seems simple, but this process is naturally complicated with extremely nonlinear dynamics. As a pendulum links represent the thigh and the shank of the human. The upper body will attach to the thigh by hip, the knee will attach thigh to the shank. To acquire a complete motion of all muscles, it is required to accomplish two control actions applied at the joints. Two control approaches which are sliding mode control and H<sub>2</sub> control are combined in this work to control the human swing leg system. The proposed mixed H<sub>2</sub> Sliding Mode Controller (H<sub>2</sub>/SMC) is a new control algorithm conducted to give better performance than if only one of them is used. The results show that the proposed controller can effectively achieve more desirable performance and robustness.

**Keywords** – Human Swing Leg; MIMO System; Sliding Mode Control; Uncertain System.



## Intelligent Fuzzy PD Controllers Design for XY Table of Semiconductor Packaging Based on ALO

**Zeyad A. Karam**

College of Information  
Technology Engineering,  
Al-Nahrain University, Iraq  
zyad\_karam88@yahoo.com

**Shahad S. Ghintab**

Communication Department,  
AL-Mansour University  
College, Iraq  
shahad.ghintab@muc.edu.iq

**Aymen M. Al-Kadhimi**

College of Information  
Technology Engineering,  
Al-Nahrain University, Iraq  
aymen\_alkadomi@yahoo.com

### Abstract:

Computer numerical control (CNC) machines have resulted in releasing the industry in a fast way, especially in the last decades. One of those CNC structures is the two-dimension (XY) motion table of semiconductor packaging. The type of process that is done by these machines is quite precise in positioning stage. The (XY) table has a nonlinear model which is caused by both of the electrical parts and the motion friction parts, and that leads to making the positioning process inaccurate. This paper presents two intelligent fuzzy logic controllers (FLC) that are used in controlling the motion position of the (XY) table nonlinear model. The first controller is the fuzzy proportional derivative PD-like FLC and the second is feedback fuzzy PD-like FLC with forward gain. The Ant Lion Optimization (ALO) is used to obtain the optimal controllers gains based on fitness function which gives minimum control signal characteristics of a minimum settling time, rise time and overshoot. The results show that the proposed controllers enhance the control signal characteristics compared with the previous works in literature.

**Keywords** – X-Y Table; PD - Like FLC; ALO.

## A Chattering Free Sliding Mode Observer with Application to DC Motor Speed Control

**Shibly A. AL-Samarraie**

Control and Systems Engineering  
Department, University of Technology, Iraq  
60132@uotechnology.edu.iq

**Mustafa H. Mshari**

Computer Engineering Department,  
AL-Esraa University  
mustafahmshari@esraa.edu.iq

### Abstract:

The main drawback of the classical sliding mode observer is the chattering problem which is eliminated in the present via replacing the signum function with an approximation to get approximate classical sliding mode observer. When the signum function is replaced with an approximating one, the estimation error will not go to zero anymore, but it will go to a bounded region around the origin. In this paper, the bounded region is obtained and controlled by adjusting the parameters of the proposed observer. The DC motor system suffers from a perturbation vector, and unmeasured angular acceleration is utilized as an application to a nonlinear controller based on the proposed observer.

**Keywords** – sliding mode equivalent term; chattering elimination; DC motor speed control.

## $H_\infty$ Loop-Shaping Robust Controller Design of Anesthesia System

**Safanah M. Raafat**

Control and Systems Engineering  
Department, University of Technology, Iraq  
safanamr@gmail.com

**Rawnaq Adnan**

Control and Systems Engineering Department,  
University of Technology, Iraq  
rawnaqalkawaz@gmail.com

### **Abstract:**

Robustness is the capability of a designed control system to preserve its stability and effectiveness in different conditions. This work inscribes a case study for designing a robust controller for the depth of anesthesia (DoA) motivated by the drug Propofol. The  $H_\infty$  loop-shaping method is utilized to design the controller for Propofol dosing using the Bispectral Index (BIS) model. The veracity of the proposed method is proved by numerical simulations. Moreover, the proposed method can attain the design requirements and have a fully tracking performance. In addition to the advantages of the loop shaping method, an easy realization is considered another advantage of loop shaping. The simulation results show the superiority of the intended method in terms of simple structure, robust tracking performance, and control effort.

**Keywords** – Robust Control;  $H_\infty$  Loop Shaping; Depth of Anesthesia.

## System on Chip Implementation of Compiler Stack with a Delimiter Matching Application

**Sarmad F. Ismael**

College of Electronic  
Engineering, Nineveh  
University, Mosul, Iraq  
sarmad.ismael@uoninevah.ed  
u.iq

**Omar T. Zyad**

College of Engineering,  
University of Mosul,  
Mosul Iraq  
omar.zyad@googlemail.  
com

**Yahya T. Qassim**

School of Electronic Engineering,  
Griffith University, Brisbane,  
Australia, yahya-  
taher.qassim@griffithuni.edu.au

### Abstract:

In this paper, multiple stacks are implemented in software and multi-core hardware System on Chip for suitability and improvement of performance speed. The hardware stacks are tested with the application of delimiter matching in a program, and they showed faster runtime compared to the software-based stacks. The implemented design of 16 programmable logic cores on the Xilinx Zynq-7000 chip located on the Zybo board has achieved a runtime of 13.9ms when applying a matching delimiter test on a code of 16 random equations written in C language.

**Keywords** – Compiler stack; Delimiter matching; System on chip (SoC); Hardware/software co-design.

## Human Action Recognition based on Motion Velocity

**Luma I. Abdul-Kreem**

Control and Systems Engineering Department., University of Technology, Iraq  
60021@uotechnology.edu.iq

### Abstract:

In this article, we propose a model for human limbs detection and action recognition. The model simulates the functionality of the visual system to identify speeds and directions of any motion by using computational mechanisms underlying the perception of biological motion. Here, local motion and motion velocity of human limbs are investigated. Two different types of cells in the visual cortex are modeled and presented in two stages. The first stage simulates the functionality of the primary visual cortex where the response of this area drives from the local flow motion. While the second stage mimics the responses of the middle temporal cells where these cells respond strongly to the motion velocity. The model detects eight different directions and two speeds. Our model was tested and evaluated using different kinds of actions where good results are achieved.

**Keywords** – Pattern recognition; Optic flow; Motion detection; Bio-inspired model.

## Video Compression Based on Motion Compensation and Contourlet Transform

**Zaid Haitham**

College of Engineering, Al-Mustanseria  
University, Iraq  
zaid.haitham21@gmail.com

**Maher K. Al-Azawi**

College of Engineering, Al-Mustanseria  
University, Iraq  
maher\_km1958@yahoo.com

### Abstract:

The extensive use of multimedia technology by different communication devices increases the data flow over the transmission media; The researchers try to find an efficient way to compress data to preserve a space in storage or to ease transmitting it over media. Video compression techniques are developed in many areas such as (educational and medical, ...etc.). Contourlet transform (CT) is used in this paper with a motion compensation technique (MC) for video compression purposes. CT has a good ability to retain image details because it avoids downsampling to a high-frequency sub-band, and the coefficients are also very sparse, by exploiting these features CT is used along with MC which overcomes the disadvantage of not synthesizing the current frame from the previous frame accurately such as in simple frame differencing technique. In this paper CT is applied to two frame's prediction techniques of the video: simple frame differencing (classical method) and motion compensation. The results show the excellence of CT with MC, where the compression efficiency is improved. Results have obtained with these techniques in terms of Peak Signal to Noise Ratio (PSNR), Compression Ratio (CR) and a Bit Per Pixel (BPP).

**Keywords** – Video Compression; Contourlet Transform; Motion Compensation; Block Matching.

## Audio Security Based on LSB Steganography and 4-D Lu System

**Hussein A. Abdulkadhim**

College of Engineering  
University of Diyala, Iraq  
hussein73@mail.ru

**Jinan N. Shehab**

College of Engineering  
University of Diyala, Iraq  
eng\_jinan83@yahoo.com

**Ali Albu-Rghaif**

College of Engineering  
University of Diyala, Iraq  
ali.alburghaif@yahoo.com

### Abstract:

Due to the huge progress made in communication and information technology, high-level security is required. Hence, with the many techniques emerged; therefore the main task is how to secure the information from hackers or to be manipulated. In this work, a security audio system based on cryptography and steganography techniques is proposed. The advantages of combining these techniques in a single system are to reduce the risks of editing the cipher information and to eliminate the risks of detecting the hidden information. In our system, 4-D Lu chaotic system is used to cipher the audio (i.e., secret message), to be hidden in the image (gray or color). Eventually, a Least Significant Bits method (LSB) is adopted for hiding the cipher information. Moreover, the use of 4-D chaotic system provides an efficient security key, which makes it more difficult to extract the original information by attackers. The analysis utilized a peak signal to noise ratio (PSNR) and mean-square error (MSE). The results demonstrate that both of the secret audio and cover image are maintained in the receiver side.

**Keywords** – Cryptography; Steganography; LSB algorithm; 4-D Lü system; Audio hiding.

## Towards Optimized V2X Routing Protocol

**Taqwa O. Fahad**

Department of Biomedical Engineering,  
University of Technology, Iraq  
taqwa.odey@gmail.com

**Abduladhem A. Ali**

Department of Computer Engineering  
University of Basra, Iraq  
abduladhem@ieee.org

### Abstract:

Hybrid vehicular network communication (V2X) is a promising design technique that is emanated to offer the advantages of both Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication paradigms, aside from overcoming their shortcomings. However, designing a more reliable and effective routing protocol to assure utilizing the emerging advantages for such a paradigm is still a challenging task. In this context, two novel schemes are presented in this paper; the first one is expected to enhance the network performance by reducing route errors and overhead through considering multi-effective-criteria in selecting routes, as well as predicting their lifetimes, in addition, to control the dissemination-width of route requests (RREQs) during route discoveries. While the second scheme extends the first method to further argues the dissemination-depth control of RREQs aiming to reduce the overhead of unnecessarily repeated attempts of route discoveries. Furthermore, intelligent techniques of artificial bee colony (ABC) optimization and fuzzy logic are employed in the proposed schemes. The conducted results through simulation validate the investigated schemes.

**Keywords** – V2X environment; Optimized routing protocol; Multi-criteria routing decision; Adaptive route lifetime; RREQ dissemination width/depth control.



## A New 2D H'énon-Logistic Map for Producing Hyperchaotic Behavior

**Nadia M. Ghanim Al-Saidi**

Department of Applied Science, University of Technology, Iraq  
100288@uotechnology.edu.iq

### Abstract:

Chaos has been determined in several phenomenon by designing models to describe cardiology, chemical reactions, electronic circuits, laser technology population dynamics, turbulence, and climate forecasting. It comes in two states, continuous and discrete. Due to their complex behavior, the discrete chaotic systems received much attention upon continuous systems. In this paper, we introduced a new discrete hyperchaotic system based on Hénon and logistic maps; we called it 2- dimensions Hénon logistic maps (2D-HLM). Its dynamical behavior is studied through several chaoticity tests to prove that it achieves good performance of shuffling and diffusion. Some of the utilized analyses are; time-series analyses, fixed point and eigenvalues, bifurcation diagram and Lyapunov exponent.

**Keywords** – Chaotic system; Lyapunov exponents; Hyperchaotic system; Bifurcation.

## A Secure Messaging for Internet of Things Protocol based RSA and DNA Computing

**Saba S. Ibraheem**

College of Information,  
Al-Nahrain University, Iraq  
eng.sabasaad88@gmail.com

**Ali H. Hamad**

Al-Khawarizmi College of  
Engineering, University of  
Baghdad, Iraq  
ahamad@kecbu.uobaghdad.edu.iq

**Ali Sadeq Jalal**

College of Information,  
Al-Nahrain University,  
Iraq  
asaj@ieee.org

### Abstract:

Video surveillance is one of the most secure and protected applications in modern cities and facilities. Local video processing and decision making will reduce the time and cost of such systems. For distributed camera monitoring system over a wide area, data transfer over the internet become essential, and hence the system would be an internet of things application since these nodes need to communicate with each other. In this work, an encryption-decryption algorithm based on RSA and DNA computing is used for messages transfer over MQTT protocol between the distributed nodes of a camera system which is equipped with an intelligent processing unit. The system has been implemented using open source python language with Linux operating system.

**Keywords** – Internet of Things; Video surveillance; DNA computing; MQTT protocol.

## New Performance Enhancement of Adaptive IIR Filtering Applications

**Thamer M. Jamel**

Department of Communication Engineering,  
University of Technology, Iraq  
drthamerjamel@gmail.com

**Karam K. Naji**

Department of Electrical Engineering,  
University of Technology, Iraq  
nkaramqays@gmail.com

### Abstract:

In this paper, a modified version adaptive Infinite Impulse Response Least Mean Square (IIR-LMS) is presented. This new proposed algorithm tries to enhance the Performance of Previously Proposed LMS (PPLMS) algorithm by overcome and avoid some of its drawbacks which are a higher level of miss-adjustment at steady state, and the need to know a statistical feature of the input signal in order to calculate the diagonal convergence factor matrix (MMAX). The new proposed algorithm is called Fast Adaptive LMS (FALMS), which uses an appropriate time-varying value of the  $M(k)_{MAX}$  instead of fixed value (i.e.,  $MMAX$ ).  $M(k)_{MAX}$  will be defined by the energy of the input signal. The FALMS express performance improvement such as fast convergence speed and minimize the level of miss-adjustment compared to IIR-LMS, IIR-NLMS (Normalized LMS) and PPLMS for system identification IIR application.

**Keywords** – Adaptive IIR Filter; System Identification; IIR-LMS; IIR-NLMS.

## Compact Dual-Band BPF Based on Quarter Wavelength SIR for WiMAX and WLAN Applications

**Emad S. Ahmed**

Department of Communication Engineering,  
University of Technology, Iraq  
30029@uotechnology.edu.iq

### Abstract:

This study presents a design procedure of microstrip bandpass filter based on quarter wavelength step impedance resonator (SIR). The frequency response of the proposed filter covers the 3.5 GHz worldwide interoperability for microwave access (WiMAX) band licensed by IEEE 802.16e and the 5.825 GHz wireless local area networks (WLANs) band licensed by IEEE 802.11a. Dual-band performance can be achieved merely in SIR by adjusting its electrical length and impedance ratios. Three transmission zeros with skirt shape response around the centers of the bands were achieved through proper coupling between ports and the resonator. Additional transmission zeros were introduced using stop band stubs, to enhance the out-of-the band rejection of the filter frequency response. CST microwave studio and SONNET full-wave electromagnetic simulator were used to validate the simulation results. The proposed filter can be widely used in wireless communication applications.

**Keywords** – Bandpass filter; Dual-band; Spurlines, SIR; Compact filter design.

## A Compact Wearable UWB Antenna Based on a Flexible Solar Panel for Self-Powered Wireless Systems

**Yasir Al-adhami**

Department of Electrical and Electronic  
Engineering, University of Gaziantep,  
Gaziantep, Turkey  
Yasir.aladhami@gantep.edu.tr

**Ergun Erçelebi**

Department of Electrical and Electronic  
Engineering, University of Gaziantep,  
Gaziantep, Turkey  
ercelebi@gantep.edu.tr

### Abstract:

In this paper, an experimental study is performed to realize the electromagnetic properties permittivity ( $\epsilon_r$ ) and permeability ( $\mu_r$ ), of a solar panel substrate with SRR inclusions. The proposed research is conducted for modern wireless communication applications. The solar panel structure is based on a flexible layer of PTFE. The SRR structure is constructed from two concentric rings of three periodical unit cells in their lattice. The substrate layer, based solar panel, properties are measured using a modified Nicholson-Ross-Weir formulation (NRW) to retrieve  $\epsilon_r = \epsilon_r' + j\epsilon_r''$  and  $\mu_r = \mu_r' + j\mu_r''$  from the measured S-parameters. The Finite Integral Technique (FIT) simulations based on CST MWS software package formulations is invoked to evaluate the S-parameters based on the retrieved  $\epsilon_r$ ,  $\mu_r$  and compare them to their relative measurements. Next, a PTFE sample is used to validate the proposed technique. It is found that the properties of the PTFE sample are quite comparable to those published in the literature where  $\epsilon_r = 2.07 + j0.001$  and  $\mu_r = 0.999 + j0.0001$ . Finally, an excellent matching is realized between the measured and simulated results.

**Keywords** – Ultra-Wide Band Antenna; plasmonic antenna; solar cell; ultra-wide band.

## Updated Techniques For Advance LTE Downlink Model: Investigation and Evaluation

**Noor N. Edan**

College of Information Engineering,  
AL-Nahrain University, Iraq  
noornaserice@gmail.com

**Nassr N. Khamiss**

College of Information Engineering,  
AL-Nahrain University, Iraq  
nassrnafea@gmail.com

### Abstract:

This paper implements an interactive up-and-running transceiver system models for Advanced Long-Term Evolution (LTE) downlink physical layer that investigates and clarifies performance for several effects considering crucial aspects in the design parameters of mobile systems over fading and LTE-Specific channel models. Carrier Aggregation (CA), High Order Modulation (HOM), Multiple-input and Multiple-output (MIMO) utilization, channel estimation, equalization and Link Adaptation enabling techniques have been implemented and investigated in this model. This paper is achieved a transmission bandwidth of about 34.8500 and 19.9000 MHz by aggregating three non-symmetric and two symmetric component carriers (CCs), respectively. At high signal power regions, significant enhancement in the data rate obtained with 256- QAM which applied as HOM over limited transmission bandwidth. The paper also implemented different MIMO schemes that validate the capability of the system to deal with the fading nature of the channel, or its ability to accommodate higher data rates as the Signal-to-Noise Ratio (SNR) increases. To mitigate system degradation due to multipath fading, this paper examined two MIMO detection schemes with ideal and pilot-assisted channel estimation techniques. Finally, the paper showed that the available spectrum exploited efficiently with link adaptation techniques by increasing the number of supported subscribers.

**Keywords** – Advanced LTE; Carrier Aggregation; HOM; Channel estimation; Link Adaptation.

## Optimal Features Selection for Radar Signal Classification with Different Targets Situation

**Ghufran M. Hatem**

Najaf Technical College Al-Furat Al-Awsat Technical University, Iraq  
ghufranmahdi@etcn.edu.iq

**Thamir R. Saeed**

Department of Electrical Engineering, University of Technology, Iraq  
thamir\_rashed@yahoo.com

**Jafar W. Abdulsadah**

College of Engineering, University of Baghdad, Iraq  
jafarwadi@yahoo.com

### Abstract:

The detection of the target depends on the accuracy of the classification of the radar return signals. This classification accuracy is based on the features which extracted from that signal. This paper presents an optimal algorithm for select optimal features. Three cases were studied of the situation of targets in receiving signal; single, multi-, and close multi-targets. The types and number of features represent the base of the algorithm, while the processing time and the classification rate represent the criteria for features selection. Hybrid methods, which it is combines the optimum characteristics of wrappers and filter methods are used for making the compromise between the number of features and best candidate subset. Multilayer perceptron back propagation neural network has been used as a classifier, while the classification is 98% for single target with two third processing time of multi-targets for the same classification rate, and nearly half processing time for the close-multi target.

**Keywords** – Features Selection; Signal Distribution; Signal Situation.

## A Compact Fractal-Based Asymmetrical Dipole Antenna For RFID Tag Applications

**Ali S. Jalal**

College of Information Engineering,  
Al-Nahrain University, Iraq  
asaj@ieee.org

**Alyani Ismail**

Fakulti of Engineering, Universiti Putra  
Malaysia, Selangor, Malaysia  
alyani@upm.edu.my

### Abstract:

Size reduction, among many other parameters, is one of the main challenges encountering antenna design for RFID tag applications. For this, different fractal geometries are found to be a good candidate. In this paper, a design of compact fractal-based asymmetrical dipole antenna integrated with Split Ring Resonator (SRR) is proposed. A Minkowski fractal tag loaded with a square SRR on its back plane, is designed for Ultra High Frequency (UHF) band Radio Frequency Identification (RFID). Modelling and performance assessment of the proposed antenna are carried out using CST microwave studio. Results reveal that the antenna has a size of  $82 \times 87 \times 1.6$  mm<sup>3</sup> and provides a read range of 2.17 m. These parameters together with other radiation characteristic make it suitable for RFID applications.

**Keywords** – RFID; Tag antenna; Compact size antennas; Fractal antenna; SRR.



## Robust Image Watermarking Against Crop and Rotation Attacks for Public Communication Networks

**Ahmed T. Thahab**

College of Engineering,  
University of Karbala, Iraq  
toeahmed@gmail.com

**Haider I. Shahadi**

College of Engineering,  
University of Karbala, Iraq  
haider\_almayaly@yahoo.com

### Abstract:

In public communication networks such as the internet, users can easily share and access multimedia products such as images, videos, and audios. Copyright protection is a vital issue to prove the ownership of products in these networks. Consequently, digital watermarking that hide invisible watermark or logo plays a major role in overcoming copyright issue. However, any person has access to multimedia products can use these products. Also, there are professional attackers can remove the watermark or logo without loss the visibility of the multimedia product and claim their ownership for the digital products. This study proposes an image watermarking model that only allows for authorized users to use the watermarked image. This model is robust against crop and rotation attacks. It is based on the proposed embedding method that we named a "concentric rectangles," which embeds data in a rectangle starting from the center toward outer boundary to overcome the crop and rotation attacks. The resulted watermarked image is distorted in such a way to be recognized by any user, but only the authorized one can obtain a high quality of the watermarked image. The experimental results of the proposed model show that the embedding capacity can reach up to 25% from the size of the host image with watermarked image quality above 40 dB in terms of peak signal to noise rotation (PSNR). Furthermore, the proposed model is fully retrieval for the watermark image (logo) and the logo still retrieved with a recognized vision until 10 dB of signal to noise ratio of noise adding.

**Keywords** – image watermarking; Concentric rectangles; crop attack embedding capacity; robustness; embedding capacity.

## A UWB Monopole Antenna Design based RF Energy Harvesting Technology

**Taha A. Elwi**

Department of  
Communication Engineering,  
Al-Mammon University  
College, Iraq  
taelwi82@gmail.com

**Omar A. Tawfeeq**

Department of  
Communication Engineering,  
Al-Mammon University  
College, Iraq  
otna.90@gmail.com

**Yahiea Al-Naiemy**

Budapest University of  
Technology and Economics,  
Budapest, Hungary  
yahiea@hvt.bme.hu

**Hayder S. Ahmed**

Department of Communication Engineering,  
Al-Mammon University College, Iraq  
hayder.2015.s@ieee.org

**Lajos Nagy**

Budapest University of Technology and  
Economics, Budapest, Hungary  
nagy@mht.bme.hu

### Abstract:

In this paper, an Ultra-Wide-Band (UWB) printed monopole antenna based Hard Surface (HS) is proposed for RF energy harvesting to serve the application of the Internet of Things (IoT). The proposed antenna is constructed of a monopole of an open mouth flower patch mounted on an FR4 substrate and followed by an HS array. The antenna is backed with a partial ground plane to enhance the antenna bandwidth. The stability in the antenna radiation pattern over the entire frequency band is achieved by introducing three rows of the proposed HS based on H-Resonators (HS-HR) next to the patch edge. Such arrays provide an Omni directional antenna at several frequency bands that suit the application of RF energy harvesting. The array of the proposed HS-HR provides high electromagnetic impedance within the frequency band of interest toward the patch length. Numerical simulations are accompanied using CST MWS and HFSS software packages to evaluate the antenna performance. Finally, the related measurements to the antenna performance and RF harvesting are conducted at 2.45GHz. It is found that the proposed antenna provides a conversion efficiency of 35% with an acceptable gain-bandwidth product.

**Keywords** – UWB; IoT; RF harvesting; Monopole; HS-HR.

## An Effective Combining Transformer to Relieve Fiber Nonlinearity in CO-OFDM System

**Liqaa A. AL-Hashemi**

College of Engineering, Basra  
University, Iraq  
leqaa.abdulsattar@gmail.com

**Sinan M. Abdul Satar**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
sinansma@yahoo.com

**Ghaida A. AL-Suhail**

College of Engineering,  
Basra University, Iraq  
ghaida\_alsuhail@yahoo.Com

### Abstract:

This paper basically concerns on reducing the impact of chromatic dispersion (CD) and the nonlinear(NL) impairments in coherent optical orthogonal frequency division multiplexing (CO-OFDM) system. In effect, the system suffers from a severe problem due to a high peak to average power ratio (PAPR); and this consequently degrades the system performance. In this paper, a new method is proposed to mitigate the PAPR problem and thereby reduce the impact of nonlinearity on the performance of the CO-OFDM system with quadrature amplitude modulation QAM mapping. The recommended new technique is based on combining two effective ways of clipping method integrated with the L2-by3 method. The simulation results indicate that the proposed method was effectively able to improve system performance by enhancing system performance via bit error rate (BER), quality factor (QF), error vector magnitude (EVM) beside the Optical Signal-to-Noise Ratio (OSNR) without the need to add any digital processing at the receiver; and eventually decrease the receiver complexity. The proposed method reduced the peak to average power ratio (PAPR) about 3.8 dB and helped to increase transmission distance by approximately 200 km.

**Keywords** – Coherent Optical Orthogonal Frequency Division Multiplexing; Chromatic Dispersion(CD); non-linearity (NL).

## **Zigzag Edges Toothed Log Periodic Terahertz Antenna Design Based on Graphene Hilbert Curve AMC**

**Hussein A. Abdulnabi**

College of Engineering,  
AL-Mustansiryah University, Iraq  
hussein\_ali682@yahoo.com

**Refat T. Hussein**

Department of Communication Engineering,  
University of Technology, Iraq  
zubid\_flower@yahoo.com

### **Abstract:**

In this work, a novel zigzag edge toothed log periodic antenna (ZETLPA) placed over Hilbert curve graphene AMC is proposed for frequency band (0.1 -10) THz. The bandwidth and resonance frequency of the antenna tuned by varying the applied DC voltage which leads to change the chemical potential of the graphene and hence changing its surface conductivity. The antenna radiating element of the ZETLPA is made from gold patch placed on Hilbert curve shape graphene AMC. An Exponential taper is used for impedance matching between the antenna and the feeder over the operating bandwidth. The antenna simulated by CST 2016 package (Computer Simulation Technology) simulation results reveal that 100 % of the frequency range satisfies when chemical potential equal to 1eV. A zigzag edges TLP is used to increase the antenna arms lengths and reduce the return losses to a minimum level as possible over the required frequency band.

**Keywords** – Graphene; Artificial magnetic conductor; Terahertz.

## Optimal Usage of LTE Advanced System to Support Multi-user in Video Streaming application

**Sarmad K. Ibrahim**

College of Engineering,  
Al - Mustansiriyah University, Iraq  
eng\_sarmadnet@uomustansiriyah.edu.iq

**Nassr N. Khamiss**

College of Information Engineering,  
Nahrain University, Iraq  
nassrnafea@gmail.com

### Abstract:

LTE-advanced is an emerging and promising technology to produce mobile net access to next-generation transmission services such as voice and video. Advance Video compression technology is High-efficiency video coding (HEVC) that is providing high-definition video (HD), Ultra-High-definition (UHD) and 4K for clients with video traffic designed to denote the majority of data flow in the mobile system, providing users with a quality of experience (QoE) in advance network. This paper has two main objectives. The first aim is to propose a new scheduling algorithm and compare it with traditional algorithms are Round Robin and Proportional Fair. The second objective is to evaluate the two modern video coding standards AVC and HEVC over LTE advanced system, to find the best way video codec to transfer video data with the best quality and more users. According to the results obtained, the proposed algorithm achieves more throughput than from others algorithm. The paper result also can be concluded that the video HEVC can be used efficiently in low bandwidth surroundings. HEVC offers savings in the average bit rate of 47.4% and 40.8% relation to AVC.

**Keywords** – LTE-ADV; HEVC; AVC.

## Miniaturized Double-patch Antenna Design for WLAN Communication with CSRR DGS

**Noor A., AlShaikhli**

College of Information Engineering,  
Al-Nahrain University  
engineer.noor@yahoo.com

**Ali S. Jalal**

College of Information Engineering,  
Al-Nahrain University  
asaj@ieee.org

### Abstract:

In this paper, a microstrip double patch antenna is designed using CST microwave studio suite 2016. The designed antenna is constructed of two square patches on the top layer and a Complementary Split Ring Resonator (CSRR) as a Defected Ground Structure (DGS) on the grounded bottom layer. The antenna is set to operate at the frequency 5.8 GHz using an FR4 material as the substrate with dielectric constant of 4.3 ( $\epsilon_r$ ) and height of 1.5 mm (h). The proposed antenna can be utilized for the Industrial, Scientific, and Medical (ISM) band and Wireless Local Area Network (WLAN) applications. The proposed antenna can be fabricated at a low cost since it is compact with a low profile and good isolation. The size of the antenna is 64.5×36.25×1.5 mm<sup>3</sup>. The integration of the CSRR at the ground plane results in a size reduction of 35% and a better impedance matching ( $S_{11} = -39.6$  dB), while it was -23 dB without CSRR. The parameters of the antenna such as the input reflection coefficient, VSWR, far field characteristics and radiation pattern has been simulated and analyzed.

**Keywords** – Microstrip antenna; WLAN; CSRR; DGS.

## A Circular Patch Antenna Based Substrate Integrated Waveguide Technology for 5th Generation Systems

**Murooj A. Mohsin**

Department of Electrical Engineering,  
University of Technology, Iraq  
murooj.aladeem@gmail.com

**Ali J. Salim**

Department of Electrical Engineering,  
University of Technology, Iraq  
alijsalim@gmail.com

### Abstract:

An SIW based antenna is introduced in this paper for 5G Applications. The proposed antenna consists of a circular slot and a circular patch printed on the top of a single layer substrate. The proposed antenna structure is fed by a 50  $\Omega$  microstrip transmission line. An FR-4 as substrate material with a dielectric constant of 4.3 and height of 0.635 mm. Simulation results showed that the antenna resonates at 30.74 GHz and a bandwidth of 1.176 GHz. The return loss is equal to -48.1 dB with a gain of 5.88 dBi. The overall dimensions are 20×15 mm. The antenna has been designed and simulated using the full wave simulator MWS CST.

**Keywords** – Substrate Integrated Waveguide (SIW); planar antennas; 5G systems antenna.

## Wideband Serial Hybrid Fiber Amplifier Utilizing Higher Order Stimulated Raman Scattering

**Abdulla K. Abass**

Department of Laser  
Engineering, University of  
Technology, Iraq  
140042@uotechnology.edu.iq

**Mudhafar H. Ali**

Department of Electrical  
Engineering, AL-Iraqia  
University, Iraq  
muthafarh@yahoo.com

**Mohammed A. Saleh**

Department of Electrical  
Engineering, AL-Iraqia  
University, Iraq  
englaser@yahoo.com

**Satea H. Alnajjar**

Department of Electrical Engineering,  
AL-Iraqia University, Iraq  
sateaahn@gmail.com

### Abstract:

In this paper, wideband serial hybrid fiber amplifier is simulated utilizing higher order stimulated Raman scattering (SRS). The amplifier structure is consisting of 3 m erbium-doped fiber and 7 km of dispersion compensating fiber (DCF) as the gain medium for an erbium doped fiber amplifier (EDFA) and Raman fiber amplifier (RFA), respectively. The proposed amplifier produced wide flat-gain bandwidth about 90 nm extended from 1520 nm to 1610 nm by combining two fiber amplifiers with different amplification bands; the EDFA pumped by 1480 nm for conventional band (C-band) and RFA pumped by 1410 nm for short band (S-band). The long band (L-band) is achieved from RFA pumped with low power at 1490 which is boosted by second-order SRS. An optical average gain level of 20 dB and average NF of 7 dB are obtained by optimizing the pump power at 40 mW and 800 mW for erbium and Raman pump, respectively.

**Keywords** – Fiber amplifier; Hybrid fiber amplifier; second order RFA.



## A Dual-Band BPF Based on Asymmetrical-Meandered Configuration for Communication Systems

**Ali J. Salim**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
alijsalim@gmail.com

**Sabah A. Gitaffa**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
sabahahg@yahoo.com

**Mohand T. Salman**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
mohanadsa@yahoo.com

**Jawad K. Ali**

Department of Electrical Engineering,  
University of Technology, Iraq  
jawadkali@theiet.org

### Abstract:

In this paper, a Dual-band bandpass filter (BPF) Filter is presented. The main part in the design of this filter depends on using a rectangular loop such that each two sides of the loop have the same configuration. The filter performance has been evaluated of the proposed filter have been carried out using the Microwave Studio Suite, CST electromagnetic simulator. Rectangular loop dimensions are  $13 \times 11 \text{ mm}^2$  while the overall filter dimensions are  $34 \times 13 \text{ mm}^2$  using a substrate having a relative dielectric constant of 6.15 and thickness of 1.5 mm. The obtained results show a dual band with 2.45 GHz and 5.2 GHz. These features offered by the proposed filter make it more suitable for use in the design of modern wireless communication.

**Keywords** – Miniaturized Band Pass Filters (BPFs); Compact BPF filter; Dual-band BPF Filter.

## Performance Comparison of Hybrid Chaotic Maps Based on Speech Scrambling for OFDM Techniques

**Ammar M. Raheema**

College of Engineering,  
University of Kerbala, Iraq  
ammam.muslim@uokerbala.edu.iq

**Sinan M. Abdul Satar**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
sinansma@yahoo.com

**Sattar B. Sadkhan**

College of Engineering,  
Babylon University, Iraq  
drengsattar@ieee.org

### Abstract:

This paper presents a speech encryption model, that uses two different chaotic maps (Hennon and Logistic maps) based on the OFDM technique. The purpose of using the encrypted chaotic key in OFDM techniques is to improve the Bit Error Rate (BER) performance in receiver side which has robustness against AWGN effects, thus increasing the security of data transmitted. In the last few years, a great research effort has been devoted, concerning secret chaotic key as compared with the conventional OFDM modulation schemes; Chaotic maps have a wideband, non-periodic, unpredictable nature, very sensitive to initial conditions; so chaotic map is used for security. This paper<sup>1</sup> uses two chaotic<sup>8</sup> maps Logistic & Hennon<sup>3</sup> each individually to create encrypted undercover keys and compares a model performance between them. The comparison showed that the performance is similar to the two chaotic maps with a very small difference between them (After SNR=16 dB the BER=10<sup>-3</sup>). As for residual Intelligibility Measurements, they are very close, and there is little difference about the limits (0.01-0.1) for R, SSNR, and CD test. The suggested model has been carried out by employing MATLAB by utilizing SIMULINK (R2018b). Execution of this paradigm is studied the good outcomes.

**Keywords** – Hybrid Chaotic,; OFDM,; Speech Scrambling.

## Radio over Free Space Optical Communication System Experimental Setup & performance analysis

**Kanat M. Abdulhussain**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
Alkimaa5@gmail.com

**Alaa H. Ali**

Department of Electrical  
Engineering, University of  
Technology, Iraq  
140007@uotechnology.edu.iq

**Shehab A. Kadhim**

Ministry of Science &  
Technology, Iraq  
shkadhim@yahoo.com

### Abstract:

In this paper, we present an experimental study on RF signal transmission over turbulent free-space optics (FSO) channel. The results demonstrate the possibility of applying FSO links to transmit RF signals and using them as guidelines in designing, prediction and evaluation of an advanced dense wavelength division multiplexing (DWDM) RoFSO system capable of transmitting multiple RF signals. Analytical modeling of the system is also conducted to identify the main parameters in assessing RF signal transmission performance by using FSO links. The results confirmed that the effect of scintillation on RF-FSO system performance could be estimated through applying a simple estimation equation and satisfactory results are obtained from comparing the experimental and theoretical derived data under weak to strong turbulence.

**Keywords** – free-space optics; Radio over Free Space; Optical Communication System.

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