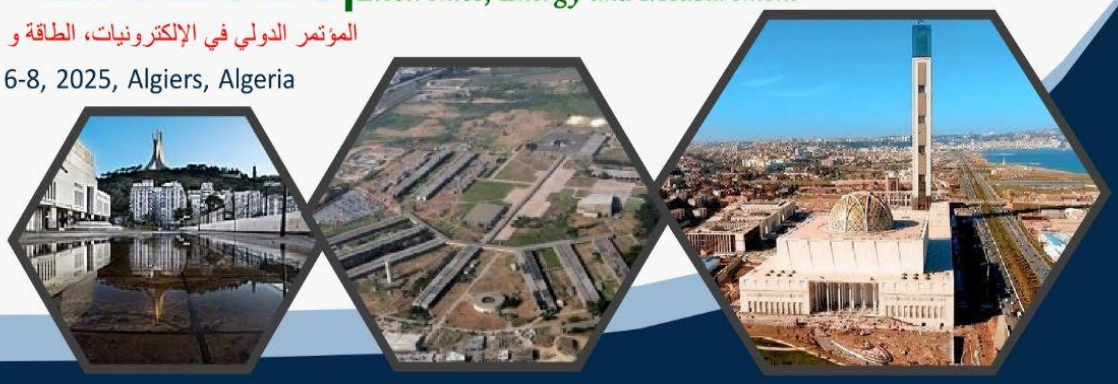
IC²EM'2025 | The 3rd International Conference on Electronics, Energy and Measurement

المؤتمر الدولي في الإلكترونيات، الطاقة و القياس

May 6-8, 2025, Algiers, Algeria



Conference abstracts

https://ic2em2025.usthb.dz/

Miloud Benmedjahed, Samir Mouhadjer, Abdeldjalil Dahbi, Abderrahmnane Khelfaoui, Omar Djaafri, Ahmed Bouraiou: *An overview of Adrar Wind Resources in Southern Algeria; Using Wind Atlases to Compute Wind Distribution Parameters*

Abstract

This paper focused on wind energy and explored the potential for wind energy production in Adrar, a location in southern Algeria, that is a hub for renewable energy. Wind atlases are useful for planning projects, assessing wind dispersion, and arriving at well-informed conclusions. In order to assess wind resources, field measurements and data analysis were conducted at three stations (Adrar, Oulef, and Reggan). The findings of the wind map analysis were then compared with the energy production and wind energy calculated using the QGIS application. Another tool utilized to assess the area's potential for producing wind energy was a Whisper 200 wind turbine. The wind speed is variable, between 2% and 14%. The data collected from the three stations revealed significant variations in wind speed and Weibull parameters across the Adrar region. The findings from the wind map analysis were consistent with the energy production and wind energy calculated using the QGIS application. The measurements indicated that the Whisper 200 wind turbine could be a viable option for harnessing wind energy in the area, with the measured wind speeds falling within the expected range. These results highlight the potential for utilizing wind power as a renewable energy source in the Adrar region.

==========

Lamine Medekhel, Chouaib Labiod, Mohamed Toufik Benchouia, Kamel Srairi, Ridha Meneceur, Mohamed Benbouzid: *Interactions between Cathodically Protected Pipelines and Grounding Systems of Photovoltaic Energy Installations*

Abstract

This paper analyzes a cathodic protection (CP) system powered by photovoltaics for oil pipelines in real-world settings, focusing on enhancing its performance in remote areas. It identifies operational challenges, particularly the interference between the photovoltaic (PV) grounding and cathodic protection grounding systems. The implementation of galvanic isolation effectively mitigates this interference, thereby improving overall reliability and protection performance. The proposed solution facilitates seamless integration of components, ensuring consistent corrosion protection and addressing the specific needs of remote oil pipeline applications. Additionally, schematics and mathematical modeling validate this approach to increase system reliability.

==========

Merouane Khodja, Sakina Radia Didouche, Mohamed Derras, Azzedine Nacer, Houcine Moulai: *Data Collection Protocol for Partial Discharges in High-Voltage Transformers*

Abstract

The detection of partial discharges (PDs) is essential for ensuring the reliability and longevity of high-voltage transformers. This paper focuses on the experimental setup and data collection. We designed a custom test cell to simulate various PD conditions and collected a comprehensive dataset using multiple electrode configurations, inter-electrode distances, and insulating materials. This paper details the experimental protocol, measurement equipment, and adjustments used to ensure high-quality data collection, forming the foundation for subsequent AI model development.

Younes Gasmi, Noureddine Bali, Karim Atif, Soufiane Belagoune: *Supervised Learning Models empowered by XGBfs and PCA for Unobservable Cyber Attacks Detection in Cyber-Physical Systems*

Abstract

Unobservable cyber-attacks, which manipulate measurement data and sensor readings in modern power systems, are commonly known as False Data Injection Attacks (FDIAs). Their ability to bypass traditional Bad Data Detection (BDD) mechanisms poses a significant threat to the integrity of power system informationSuch evasion can cause significant disruptions to system topology and lead to financial losses by misleading power system operators and control centers into making erroneous decisions during Power System State Estimation (PSSE). Detecting these attacks is critical. Therefore, this study proposes an approach to enhance the detection of such stealthy attacks. This study introduces a range of machine learning (ML) algorithms, including ensemble classifiers such as AdaBoost (ADABO) and Random Forest (RF), as well as simpler supervised classifiers like Decision Trees (DT) and K-Nearest Neighbors (KNN). Additionally, this study explores techniques for reducing data complexity and enhancing model performance by selecting the most relevant information from datasets through feature engineering. Extreme Gradient Boosting-based feature selection (XGBfs) is employed to identify the optimal feature subset, while Principal Component Analysis (PCA) is introduced as a second method for feature extraction. These techniques significantly improve model performance. The IEEE-14 bus test system has been utilized to evaluate the effectiveness of the proposed approach, with results analyzed using performance metrics and training durations.

==========

Omar Fethi Benaouda, Mohamed Mezaache, Benalia M'hamdi, Mohamed Elbar: *Diagnosis and Control of Multi-Level Inverter Fed Dual Stator Induction Machine using DTC-SVPWM*

Abstract

The need for high power applications is well met by the Dual Stator Induction Machine (DSIM), which has been increasingly used in variable speed drives in recent years. However, its complex structure still makes its control strategy a subject of research. Though more reliability is offered by the DSIM itself due to the presence of a dual stator. Fault detection is most profitable and its location most required to ensure service diagnosis for the inverter, as it remains the most sensitive part. A control strategy based on Direct Torque Control combined with Space Vector PWM for a DSIM (DTC-SVPWM-DSIM) and fault detection and location for a three-level inverter functioning under open-circuit IGBT switch faults are addressed in this paper. The enhancement of torque and flux quality owed to the proposed control strategy, as well as the effectiveness of the open-circuit fault detection and location method and the impact of the inverter on the drive system service diagnosis, are illustrated by several results.

==========

Luca Bonaventura, Lorenzo Vangelista: *On the Header Detection in LoRaWAN LR-FHSS*

Abstract

This paper proposes a novel header detection scheme for Long-Range Frequency Hopping Spread Spectrum (LR-FHSS) for Direct to Satellite Internet of Things (DtS-IoT). The main focus is on developing a general structure capable of addressing transmission challenges in Low Earth Orbit (LEO) environments, such as Doppler shift and Doppler rate effects, while maintaining limited computational complexity. Simulations have demonstrated that the system achieves valuable performance while maintaining limited resource usage. The analysis is centered on the operational requirements in the EU region.

Hadj Abdelkader Benzater, Arab Azrar, Nacerredine Lassami, Djamal Teguig, Hamza Zeraoula: *Optimized Trade-off Design of Gain and Noise Figure in LNAs for SDR-Based Compressed Spectrum Sensing*

Abstract

This paper presents a comprehensive study on the design and validation of Low-Noise Amplifiers (LNAs) optimized for Software-Defined Radio (SDR)-based Cognitive Radio Networks (CRNs). Aimed at enhancing the Signal-to-Noise Ratio (SNR) and improving compressed sensing efficiency, we developed a MATLAB-based graphical user interface to facilitate LNA design. The GUI integrates analytical methods to calculate critical parameters, including available gain, reflection coefficients, and matching networks, ensuring accuracy through comparison with simulations in Advanced Design System software. The proposed method delivers a peak gain of 17.16 dB, representing an improvement of 3.71 dB, while maintaining a noise figure of 0.35 dB, which is only 0.13 dB higher than the minimum achievable value, demonstrating an optimized trade-off between gain and noise performance. Real-case LNA parameters were used to validate the design, with ADS simulations confirming a negligible deviation of 0.02 dB in gain. These results highlight the effectiveness of the proposed approach in improving the SNR (by 7 dB) and detection efficiency for SDR-based systems.

==========

Dalila Menacer, Zine Saadi, Youcef Sahli: *Effect of Moving Lids on The Air Flow Confined in Porous 2D Cavity*

Abstract

The convective regime in a porous process confined inside a closed enclosure heated from bellow is modeled in the present paper using the Navier-Stockes equations. These are discretized by the finite difference method. All numerical tests are performed for Prandtl and Reynolds values respectively to Pr=0.71 and Re=100. The influence of some parameters such as the Darcy and Richardson numbers on the structures of the flow has been analyzed. The obtained results have detected a significant change in fluid circulation patterns within the studied configuration.

==========

Abdessalem Ryad Mebarek, Leila Merabet, Chouaib Rahli, Ayoub Rehail, Salah Saad, Mohamed Toufik Benchouia: *Enhancing Power Quality in PV-Integrated Systems: A Hybrid Adaptive Approach for Current Harmonics Extraction in Four-Wire SAPFs*

Abstract

This paper presents a simulation-based analysis of a four-wire, three-phase photovoltaic (PV) Shunt Active Power Filter (SAPF) designed to mitigate harmonic distortion and improve power quality. Implemented in MATLAB-Simulink, the system employs an adaptive harmonic cancellation algorithm based on the Widrow-Hoff ADALINE method for harmonic identification. Simulation results confirm its effectiveness in reducing Total Harmonic Distortion (THD) under fluctuating irradiance and unbalanced nonlinear loads, outperforming the conventional Adaptive LMS (Direct ADALINE) method. The proposed SAPF maintained sinusoidal, balanced source currents with minimal voltage overshoot and a near-unity power factor. Harmonic suppression was highly effective, keeping THD below 4% and reducing dominant 3rd, 5th, and 7th-order harmonics to under 1%, even under severe load imbalances and low irradiance. Additionally, stable DC link voltage ensured reliable compensation of reactive and neutral currents. These findings highlight the system's potential to enhance grid stability, support renewable energy integration, and offer a scalable solution for modern power systems.

Aboubekeur Tadjine, Farid Merahi, Abd Essalam Badoud: *Preliminary Study for the Design of Super Bidirectional Cùk Converter for Greater Efficiency and Stability of Power Conversion Under Unequal Supply Power and Consumption Power*

Abstract

This paper presents a preliminary study that aims to integrate Supercapacitor technology with Conventional Bidirectional Ćuk Converter (CBCC) circuit topology, making Supercapacitor one of the main components in its electrical circuit. The purpose of integrating the two technologies is to increase the power conversion efficiency, increasing the stability of power flow against high voltage peaks that may result from very high-power supply sources, increasing power stability against current ripples, and against current shortages when the supply power drops due to exceeding its maximum power point. Therefore, this paper presents a preliminary study to design the Super Bidirectional Ćuk Converter (SBCC), where it is possible to take advantage of the low voltage and high currents that characterize Supercapacitor technology in order to give the Ćuk converter new properties. One of the most interesting of these properties is that the role of the converter becomes a contributor to energy storage and generation, in addition to being more efficient in converting it, and more stable especially with traditional and non-intelligent control laws. During this study, a simple conditional and combinatorial logic-based algorithm was designed to control the additional switches incorporated in the converter topology investigated in this work. The simulation results in the MATLAB environment have shown the capability of SBCC to increase the power transferred to the load when the maximum power point of the supply source is surpassed. The SBCC also has the ability to absorb high voltage peaks and ensure voltage stability when the supply power is significantly higher than the consumption power.

==========

Abdelkader Halmous, Hossam E.A. Abbou, Youcef Oubbati, Mohamed Lahdeb: *Hybrid Battery-Supercapacitor Energy Storage for Standalone Photovoltaic Systems Under Cloudy Days*

Abstract

The implementation of renewable energy in remote areas is crucial but faces significant challenges, particularly due to energy storage issues. Solar and wind energy systems often experience production fluctuations, which accelerate battery degradation. This study proposes a hybrid battery-supercapacitor energy storage system to address these challenges. By employing an active control mechanism, the system stabilizes battery currents and minimizes unnecessary charge-discharge cycles caused by intermittent solar energy production. Leveraging the supercapacitor's fast charge-discharge capabilities, the hybrid setup effectively absorbs and compensates for excess energy. Simulations conducted using MATLAB Simulink on a cloudy day confirm the system's performance. The results demonstrate significant improvements compared to conventional battery-only setups, including reduced charge-discharge cycles, extended battery lifespan, and enhanced energy system stability. This solution provides a sustainable and efficient approach to overcoming renewable energy storage challenges in isolated systems.

Hossam E.A Abbou, Abdelkader Halmous, Mohammed E. Benzoubir, Abdelmoumene Delassi, Saalem Arif: *A New Under Frequency Load Shedding Scheme for IEEE 39-Bus Test System with the Presence of Renewable Energy Sources*

Abstract

The increasing use of Renewable Energy Sources (RES) in power systems introduces challenges in maintaining stability and frequency. As reliance on these intermittent sources grows, power supply reliability becomes critical. Under Frequency Load Shedding (UFLS) is an emergency control action that restores power system balance by shedding part of the load when the frequency drops below a set threshold. This study evaluates UFLS's role in ensuring a reliable power supply and preventing blackouts, especially with RES. Using ETAP software, simulations were conducted for two separation scenarios in three study cases using the "New England test system 39-node." The study assessed UFLS performance in traditional and RES-integrated systems. Results showed UFLS effectively prevents blackouts and restores frequency stability during imbalances. Additionally, the study analyzed RES's impact on UFLS and designed an effective UFLS plan considering load amounts and frequency relay response times. These findings highlight RES's effect on power system stability and underscore UFLS's importance in maintaining frequency stability.

==========

Wissem Kharzi, Malika Talha-Kedir, Nacera Meziane, Lotfi Madaoui, Hadjer Zairi, Oussama Kerdjidj: *ECG Monitoring System Using Dry Electrodes for Artifact Classification to Prevent False Diagnoses*

Abstract

This study introduces a compact and efficient design for an advanced ECG monitoring and artifact classification system aimed at addressing the limitations of traditional ECG systems based on gel electrodes, which often cause skin irritation and degradation of conductivity over time. To overcome these challenges, the proposed system incorporates Orbital 21 dry electrodes, along with high processing speed and computational microcontroller, coupled with an integrated analog front-end circuit to optimize signal quality. Subsequently, a proprietary dataset is created from the designed system, categorized into three distinct classes. This dataset is used to leverage various machine learning classifiers to analyze ECG signals effectively, ensures the accurate detection and classification of ECG signal artifacts, thereby distinguishing common artifacts from pathological patterns to enhance diagnostic precision. Moreover, this innovative approach establishes the system as a reliable and efficient health assistance algorithm, showcasing significant potential for continuous monitoring and clinical applications.

==========

Fatiha Louakhche, Ahcéne Abed, Redha Bendoumia, Ahmed Bouchekhlal: *The Slot Parameters Effect in a Siw Waveguide for Ku-Band Applications*

Abstract

Recently, Substrate Integrated Waveguide (SIW) structures have gained significant interest. This structure is an up-and-coming candidate for many circuits, including millimeter- wave applications. It is a simple solution combining planar and volumetric technologies into a single structure to benefit from their advantages. In this paper, we propose an SIW structure with two slots in the Ku band at 16 GHz. The main objective of this document is to study the effect of the width and length parameters of the slots on the reflection coefficient S11. The optimization process is performed using Ansoft HFSS software, where the design parameters of the waveguides SIW are adjusted to achieve the desired frequency response characteristics.

Hadjer Zairi, Ikram Bendjebbas, Yasmine Bahout, Hachemi Cherrih, Wissem Kharzi, Lotfi Madaoui, Malika Kedir: *Detection and Classification of Elbow Movements for Prosthetic Applications Using EMG Signals*

Abstract

Limb amputation presents significant physical and emotional challenges, impacting mobility and daily activities. To address this issue, prosthetic limbs, particularly myoelectric prostheses have been developed, offering a more natural and precise interaction by using muscle-generated electrical signals. This paper focuses on the software aspect of developing a control system for a myoelectric elbow prosthesis, evaluating various machine learning algorithms for interpreting surface electromyography (sEMG) signals. The objective is to identify the most effective algorithm for accurate sEMG signal interpretation, providing a foundation for future hardware integration. Among the evaluated models, Random Forest achieved the highest accuracy of 90.63%, outperforming SVM (86.46%), KNN (87.50%), and Decision Tree (85.42%), demonstrating its potential as the optimal solution for prosthetic control systems.

==========

Ismail Bendaas, Salim Bouchakour, Kada Bouchouicha, Amar Hadj Arab: *Monitoring Assessment of a Large-Scale Solar Power Plant in Algeria's desert Climate*

Abstract

In this work, we evaluate a large-scale photovoltaic power plant (LS-PVPP), connected to the medium voltage grid, located in Adrar, a desert climate in Algeria. The PV plant performance was carried out according to the standardized norms IEC 61 724 (IEC) using data from 2018. This assessment focused on various limitations such as capacity factor, performance ratio, reference yield, statistical indicators and the environmental variables impact on the performance ratio. The results indicate a capacity factor of 20.72%, a final yield of 4.98 kWh/kWp/day, a general system efficiency of 10.66% and a performance ratio of 71.67%. This research intends to offer statistics on the performance of an LS-PVPP in desert climate, based on a monitoring system. Researchers, solar project creators and interested parties can leverage the findings to evaluate the sustainability of the project, improve performance, and enhance economic and environmental advantages.

==========

Nadira Demik, Mohamed Tellache, Tarek Djerafi: *Meander-line based Microwave Sensor for Soil Water Content monitoring*

Abstract

This work presents a meander-line-based microwave sensor for soil permittivity and its water content (WC) monitoring. In High Frequency Simulation Software (HFSS), we have simulated our sensor structure, then calculated and presented its sensitivity (S) at a permittivity ranging from 1 to 10. To validate the simulation work, we have realized the microwave sensor using PCB technology and then used it to detect sand's WC variation from 0% to 10%. The experimental results revealed a left shift of the frequencies, justified by the increase in permittivity. The proposed sensor's S is 1.4 to 3.33 times higher than that of literature's sensors; moreover, its size is 1.21 to 3.41 times smaller.

Fatima Lounoughi, Mohamed Djendi: *Performance analysis of New Adaptive Equalizer Based Pseudo Affine Projection Algorithm*

Abstract

This paper presents a performance analysis of the decision feed forward equalizer (DFE) based on the proposed pseudo affine projection (PAP) algorithm. The DFE, combined with adaptive algorithms, is employed to mitigate inter symbol interference (ISI) during signal transmission. Its performance is evaluated through simulations using two distinct criteria: constellation diagram and the mean square error (MSE) criterion. The study investigates the impact of key parameters such the input signal-to-noise ratio (SNR), projection order, adaptation step size, and filter length, on MSE convergence. Simulations are conducted using 32-PSK, 16-PSK and 16-QAM modulation schemes. The results demonstrate the effectiveness of the DFE-PAP algorithm for digital equalization. The proposed approach achieves excellent ISI suppression and significant improvements in MSE convergence for all tested parameters. Furthermore, the DFE-PAP outperforms the normalized least mean square (NLMS) DFE algorithm, exhibiting faster and more stable MSE convergence.

==========

Kheira Lakhdari, Nour El-Houda Benalia: *A Machine Learning Solution Based on a Cloud Computing Platform Dedicated to Iot-Ia Behavioral Analysis*

Abstract

The Internet of Things (IoT) seeks to interconnect numerous devices and tools to the Internet, enabling greater control over the physical world while making it smarter and more responsive to human needs. A key challenge of IoT technology is gathering and analyzing vast amounts of data to develop AI-driven systems capable of making autonomous decisions. This paper presents a software architecture that supports an AI analysis platform designed for IoT applications. The platform leverages Big Data and Cloud-based architecture to enhance performance in managing large datasets and complex computations. It enables high-performance applications that address socio-economic issues such as traffic management, water consumption, and energy optimization. The proposed solution will be tested in a real-world scenario, focusing on the behavior al analysis of 4-wheel vehicle drivers to develop a driving classification model that assesses whether the behavior is indicative of safe driving. Such a system has potential benefits for public authorities and insurance companies, offering a means to enhance safety and reduce costs. In our study, we classify driving behaviour as dangerous or not based on speed and engine RPM. To achieve this, we implement a scoring system that assigns a risk score to each driving type, quantifying its level of danger. Experimental results demonstrate that feedback control efficiently fulfils diverse user resource demands, enhances user satisfaction, and maximizes system resource utilization.

Djahida Belayadi, Ikram Amrouche, Malak Lahouassa: *A Comprehensive Survey on the Maintenance 4.0 Technologies and its Applications*

Abstract

The fourth industrial revolution is based on the increased availability of digital technology and connectivity groups, leading to a fundamental reevaluation of manufacturing processes. One of the key factors that will ensure the success of the digital transformation of companies, and in particular, these manufacturing processes, is predictive maintenance. It increases machine life cycles, reduces downtime and its related costs, boosts quality, and increases production rates. This paper presents a comprehensive survey of maintenance 4.0 technologies and their applications, including their definitions as well as their application in maintenance. In addition, the advantages and limits of each technology have been cited. Since these technologies are complementary, how they can be integrated to promote smart maintenance is discussed.

==========

Lotfi Madaoui, Malika Kedir-Talha, Nourhane Diaf, Wissem Kharzi, Hadjer Zairi, Oussama Kerdjidj: *Zynq SoC-based Hand Motion Recognition System Using EMG Signals*

Abstract

People who have lost a hand or upper limb face significant challenges in mobility and independence, but active prostheses provide a pathway to restoring autonomy. This work presents a hardware implementation on a Zynq System-on-Chip (SoC) to recognize three distinct hand movements using electromyography (EMG) signals and a support vector machine (SVM) classifier. The software implementation achieved a recognition accuracy of 98.79%, showcasing the system's robustness. In the hardware implementation, the architecture was further optimized using parallelism techniques, which significantly enhanced processing efficiency. This optimization resulted in a sixfold improvement in speed compared to the baseline non-optimized design. These advancements pave the way for real-time, low-latency solutions in prosthetic control, enhancing user experience and functionality.

==========

Soufiane Hadiby, Dalila Beriber, Khelil Zaouche, Abdelaziz Talha: *Enhanced Grey Wolf Optimization with a Novel Pouncing Weight Strategy for MPPT in PV Systems Under Partial Shading*

Abstract

Grey Wolf Optimization (GWO) is a bio-inspired metaheuristic algorithm used in photovoltaic systems for maximum power point tracking (MPPT). This algorithm is known for its robustness and accuracy, but can still be improved. Enhanced Gray Wolf Optimization (EGWO) is a novel variant of GWO that introduces a new hunting strategy, when the wolves are close to the prey, they can now pounce toward it. This pouncing strategy drastically reduces the tracking time and reduce oscillations. In this paper, we will introduce a new parameter to this algorithm, which is an adaptive pouncing weight (PW_EGWO). The main strategy behind it is to allow the wolves to have a dynamic pouncing distance to optimize the exploration and exploitation around the global maximum power point (GMPP), ensuring precise convergence with minimal tracking time. The effectiveness of the proposed strategy is validated by numerical results obtained via MATLAB Simulink simulations.

Zeyneb Mordi, Zahir Hamouda, Mohand Lagha, Tuami Lasri: *A Compact Conformal Printed Dipole Antenna for UAV Telemetry Applications*

Abstract

This paper presents a compact conformal dipole antenna operating at 433 MHz, designed to replace the conventional dipole antenna of an unmanned aerial vehicle (UAV). The key innovation lies in directly printing the proposed antenna onto the UAV's tail boom, integrating the antenna seamlessly into the structure. This design not only reduces the antenna size but also preserves the aerodynamic characteristics of the UAV. The compactness of the antenna is achieved using a meander line technique, which effectively minimizes its physical dimensions without compromising performance. The measured results show good agreement with the simulations. In particular, a working bandwidth of 30MHz within the specified frequency range and a reflection coefficient around -30dB are demonstrated. The proposed design is compact, efficient, and easily integrable, making it a promising solution for UAV applications.

==========

Lamia Ouhib, Kara Redouane: *D-Stability-Based State and Actuator Fault Estimation for Takagi-Sugeno Systems with Immeasurable Premise Variables*

Abstract

This paper focuses on state and actuator fault estimation for Takagi-Sugeno systems with Immeasurable Premise Variables (IPV) under D-stability constraints and L2-gain analysis. This is achieved through the synthesis of a Fault Adaptive Multiple Observer (FAMO). D-stability is ensured by placing the eigenvalues of the matrices that characterize the dynamics of state and fault estimation errors within a predefined LMI region in the complex plane. The L2-gain analysis aims to minimize the effect of immeasurable premise variables. To this end, we propose sufficient and generic LMI constraints to compute the FAMO parameters. Finally, a simulation example demonstrates the validity of the proposed approach.

==========

Yassine Mohamedatni, Abdelhak Nasrallah, Sofiane Taloul, Omar Ait Hemiche, Mohamed Djouad: *Real-Time implementation of DSSS Signal Detection Based on Autocorrelation Estimation and Cumulative Peak-to-Average Ratio using SDR Platforms*

Abstract

This paper presents a novel method for detecting Direct-Sequence Spread-Spectrum (DSSS) signals based on autocorrelation estimation and the cumulative peak-to-average ratio (CPAR). DSSS signals pose a challenge for traditional spectrum sensing methods due to their low power and spread spectrum nature. The proposed method addresses this challenge by identifying peaks in the autocorrelation function and applying a CPAR criterion to distinguish DSSS signals from noise and interference. This approach offers several advantages, including robustness at low signal-to-noise ratios (SNR), no requirement for prior information about the signal, and real-time implementation capability. Simulation results demonstrate the effectiveness of the proposed method, making it a promising solution for real-time spectrum sensing in cognitive radio applications.

Yassine Mahamdi, Abdelouahab Mekhaldi, Ahmed Boubakeur , Youcef Benmahamed: *Intelligent DGA-Based Technique for Fault Identification of Power Transformers*

Abstract

Dissolved gas analysis is widely used for diagnosing faults in power transformers and has been extensively adopted by researchers to develop efficient fault diagnosis systems. In this regard, this paper proposes a novel DGA-based technique for identifying faults in power transformers. Using a dataset of 501 samples and covering six types of faults, an advanced Decision Tree-based classification method was applied to DGA data. To improve classification accuracy and reduce training time, an enhanced binary Crow Search Algorithm was employed for feature selection. Chaos mapping was integrated into the optimization process to avoid local optima. Additionally, the cross-validation technique was employed to ensure the randomized selection of data for training and testing the enhanced algorithm. The proposed method achieved a fault identification accuracy exceeding 92% for power transformers, outperforming most recently published fault diagnosis methods.

==========

Randa Hamdaoui, Yasser Bouzid, Saddam Hocine Derrouaoui, Mohamed Guiatni: *Hierarchical Immersion and Invariance based control of a Reconfigurable UAV*

Abstract

One of the most significant challenges in the field of reconfigurable drones has been achieving effective control of these systems due to their variable and adaptive structure in flight, which introduces a high level of complexity to their control. To this aim, this paper represents a nonlinear tracking control law for a reconfigurable quadrotor Unmanned Aerial Vehicle (UAV) based on Immersion and Invariance (I& I) methodology. To the best of our knowledge, the proposed controller provides the first I& I-based control results for such a drone. The control system comprises of two parts : the inner loop for the attitude control and the outer-loop for the position control. Moreover, the designed controller ensures accurate tracking of the desired trajectory and yaw angle. The results of numerical simulations are presented to demonstrate the efficiency of the suggested (I& I) control. The outcomes were satisfactory, confirming the advantages of the I& I approach for controlling reconfigurable UAVs.

==========

Haithem Boukerdoun, Abdelaziz Talha, Salim Mohammed Benmerabet: *Active and Reactive Power Control for Grid Connected with Cascaded H-Bridge Inverter*

Abstract

The transition to renewable energy has driven significant advancements in power electronics. Solar and wind energy systems require advanced power conversion technologies to ensure compatibility with grid connections. Recently, Multilevel inverters have gained widespread use in commercial and industrial applications and are increasingly popular for grid-connected systems due to their efficient power management capabilities. This paper presents a current control strategy for a cascaded H-bridge multilevel inverter, designed to manage both active and reactive power A MATLAB/SIMULINK simulation is presented to validate the proposed control method.

Mansour Makdour, Aimen Abdelhak, Hadjira Badaoui, Mehadji Abri, Bachir Rahmi, Hocine Bensalah: *A Single-Mode Tunable Plasmonic Filter Based on an Hexagonal Ring Resonator*

Abstract

A plasmonic filter with a novel design has been pro-posed using an hexagonal ring resonator coupled with two MIM waveguides for the input and output. The basic design yields a two-mode response, which is undesirable for filters. We propose a gap in the two middle sides of the hexagonal ring resonator, which results in a single-mode filter. Additionally, we have implemented sharp-tipped waveguides at the resonator-waveguide connections to improve transmission. This technique leads to a monomode filter at 851 nm, within the wavelength range of 550 nm to 1600nm. The transmission is 65.5%, with 35 nm of selectivity and a Q-factor of 24.31. The structure uses air as the dielectric and silver as the metal, with silver characterized by the Drude model. The numerical investigations were carried out using the FEM methods implemented in COMSOL Multiphysics software. The favorable filter characteristics suggest strong potential for use inall-optical devices.

==========

Assia Ould Hamou, Fatma Zohra Chelali, Raouf Sebbah: *Hand Detection for Gesture Recognition*

Abstract

Gesture recognition plays an essential role in a number of fields, facilitating natural and intuitive interactions between humans and machines. It helps people with physical disabilities to interact with technology using gestures, offering an alternative to the traditional input methods. It can also be considered as a communication tool for sign language translation. In this paper we propose an implementation of gesture recognition system using an acquired dataset under uniform background. The system utilizes various machine and deep learning methods, including a skin detection segmentation, the Local Binary Pattern (LBP) descriptor characterization, followed by K-Nearest Neighbor (KNN) classification. Additionally, a Convolutional Neural Network (CNN) was trained and implemented. The results were highly satisfactory, achieving a recognition rate of 97.25%.

==========

Maroua Nour El Houda Benbachir, Fayçal Amrani: *Compact Elliptic Resonator-Based Lowpass Filter Design with Ultrawide Stopband Performance*

abstract

This paper presents the design of a compact low-pass filter based on third-order elliptic resonator for application in radio-frequency and microwave systems. The proposed filter operates at a frequency of 3.6 GHz, achieving an insertion loss of 0.04 dB and a return loss exceeding 30 dB across the passband. To enhance the stopband performance, two pair of attenuators were integrated, enabling a wide rejection range from 3.6 GHz to 20 GHz. Additionally, complementary split-ring resonators were implemented in the ground plane to further improve the rejection levels, achieving attenuation of -20 dB. The proposed low-pass filter is very compact, with a total size of just 54 mm2. The simulation results demonstrate the filter's effectiveness in suppressing unwanted harmonics across an ultrawide stopband, with a remarkable balance between size and performance.

Khalid Dallah, Leila Grine, Azzedine Bellel, Salah Sahli, Patrice Raynaud: *Evaluation of the VOCs Sensing Capacity of Nanostructured TiO2 Film Plasma Coated QCM Transducer*

Abstract

This study investigates the use of titanium dioxide (TiO2) thin films deposited through low-frequency plasma enhanced chemical vapor deposition (PECVD) on quartz crystal microbalance (QCM) transducer for the detection of volatile organic compounds (VOCs) such as methanol, ethanol, acetone and toluene. Using titanium tetraisopropoxide (TTIP) as an organometallic precursor, the film was synthesized at plasma discharge power of 20 W and substrate temperature of about 150°C in order to improve its physicochemical and morphological features. Analysis through Fourier Transform Infrared Spectroscopy (FTIR) confirmed the formation of Ti-O bonds and the presence of functional groups like hydroxyl and carbonyl, which are important for VOCs sensing. Atomic Force Microscopy (AFM) revealed the elaboration of rough surface QCM coating leading to increased specific sensor surface area (surface to volume ratio). The elaborated sensitive layer showed high sensitivity and affinity in detecting VOC molecules with ethanol detection being particularly effective due to hydrogen bonding with surface hydroxyl groups. These results highlight the potential of PECVD in developing TiO2 sensors with increased porosity and surface area, contributing significantly to advances in environmental monitoring and industrial safety.

==========

Sara Belkisse Merrah, Amar Adane: *Environmental Monitoring System used for Autonomous Irrigation Station*

Abstract

This paper presents a smart system appropriate for environmental monitoring based on Wireless Sensor Network (WSN) using IoT systems. The meteorological sensor node used is equipped with NodeMCU ESP8266 boards and sensors to measure temperature, air humidity, and soil moisture. The locations of the nodes are sent and stored with the measured data in a MySQL database created within the Raspberry Pi micro-computer used as a LAMP server. In addition, a custom graphical User Interface (GUI) is developed and associated with the WSN to facilitate visualization and interpretation of collected data through the end user. The tests were performed for a period of three weeks. Using the experimental results, automatic irrigation is provided, thereby saving time, money, and the human effort to make the agriculture smarter.

==========

Bilal Hamidani, Okba Zeghib, Nik Rumzi Nik Idris, Abdelkrim Allag: *Mean Value Theorem Based Controller for PMSM Drive*

Abstract

This paper proposes a novel nonlinear control strategy for the field-oriented control (FOC) of permanent magnet synchronous motors (PMSMs), utilizing the mean value theorem (MVT). By integrating MVT with a sector nonlinearity transformation, the inherently nonlinear error dynamics in the state-feedback system are reformulated into a linear parameter-varying (LPV) model. Stability criteria are established through Lyapunov-based analysis, which are subsequently converted into linear matrix inequalities (LMIs) to compute the controller gains. Experimental validation conducted on a 415 W PMSM demonstrates that the proposed controller ensures precise speed tracking and robust field orientation, even in the presence of varying load torque disturbances.

Yasmine Tolba, Sarah Madi, Ahmed Riadh Baba-Ali: *Modelization and Implementation of a Motion Control System Based on the Wrist: A Smart-Watch Function*

Abstract

As smartwatches and bracelets have become the norm in our daily lives, motion sensors are constantly attached to our wrists. Movement tracking paired with a variety of algorithms can enable recognizing gestures and different types of movements. One of the possible scenarios is turning the screen of the smartwatch on and off for a smooth and immersive user experience. Machine learning algorithms provide a simple, reliable, and efficient method to achieve that. This paper goes through the process of wrist movement recognition from data acquisition to classification with multiple Machine Learning (ML) algorithms, using inertial measurement unit sensors. This approach aims to enable the model's adaptability and Edge AI, allowing the model to operate quickly, responsively, and efficiently on the watch's computing resources.

==========

Mohamed Yacine Bensouda, Ahmed Benallal, Mohamed Amine Ramdane: *A Data Reuse Fast NLMS Algorithm for Acoustic Echo Cancellation*

Abstract

This paper addresses the challenge of Acoustic Echo Cancellation (AEC) using adaptive filtering algorithms, introducing the Data-Reuse Fast Normalized Least Mean Square (DR-FNLMS) algorithm. This algorithm incorporates the Data-Reuse (DR) method into the fast NLMS framework, the DR-FNLMS algorithm ensures stability, while its tracking performance can be precisely tuned through the adjustment of the data-reuse parameter. Simulation-based performance evaluations demonstrate that the DR-FNLMS algorithm significantly outperforms the original FNLMS, particularly in terms of convergence rate and tracking capabilities, making it a robust and reliable choice for practical applications.

==========

Maroua Louglaib, Izzeddine Chalabi: *Machine-Learning-Based Parameter Estimation of Nakagami Texture of Compound Gaussian Clutter*

Abstract

Accurate and efficient estimation of the shape parameter of Nakagami texture is of considerable interest in wireless communication and radar systems, especially for constant false alarm rate (CFAR) detection. In this paper, two machine learning-based estimators are proposed. Single-layer perceptron estimator with one hidden layer (MLPE-1) and the second is a multi-layer perceptron with two hidden layers estimator (MLPE-2) to capture more complexities. The estimation performance of the proposed estimators (MLPE-1 and MLPE-2) is assessed and compared with the existing maximum likelihood estimator (MLE) and generalized moment estimator (GME). The robustness of each estimator is evaluated using root mean square error (RMSE).

Abdelkader Filali, Hamza Semmari: *Designing a Radial Turbine for ORC System: Effect of the Organic Fluid*

Abstract

Several ideas have recently been investigated in an attempt to enhance the design and performance of ORC radial turbines. However, there aren't many comprehensive studies that consider the ways in which different factors impact radial turbine performance. Thus, developing a 1-D algorithm that can forecast radial turbine dimensions under certain ORC system operating conditions is the goal and focus of the current effort. This entails utilizing MATLAB and the REFPROP program to calculate the parameters of organic fluids, such as R123 and R134a, to properly size and construct various turbine sections. Along with calculating the turbine's power and efficiency, the research also plans to calculate several static and total thermodynamic variables at each component's input and outflow. The 1-D code's output was successfully verified using data that had already been released. Later, the impact of the working fluid, namely R123 and R134a, was examined. The findings showed that the fluid type had a significant impact on the radial turbine's dimensions and performance; therefore, great care must be taken to develop ORC radial turbines that offer high efficiency for various organic working fluids.

==========

Youcef Cherifi, Yasser Bouzid, Mohamed Guiatni, Abdelwahhab Bouras: *Multi Objective Vehicle Routing Problem Using Hybrid Approach for Gas Distribution Map*

Abstract

As the threat of Nuclear, Biological, and Chemical (NBC) weapons rises, efficient gas distribution mapping and rapid detection are crucial for public safety. This study focuses on building a Gas Distribution Map (GDM) with a multiUAV system equipped with gas sensors, aiming to minimize system performance factors like mission time, total time, and the number of UAVs. The problem is modeled as a Mult Objective Capacitated Vehicle Routing Problem (MO-CVRP), and a hybrid approach combining Genetic Algorithms (GA) and Simulated Annealing (SA) is proposed to optimize this task. Simulations show that this method improves significantly the system performance while maintaining high-quality of GDMs.

==========

Amina Hamza, Djamel Addou, Imene Hadjadji: *Enhancing Dysarthric Speech Intelligibility: A Review of Techniques*

Abstract

This paper delves into the complexities of dysarthric speech, characterized by challenges such as impaired articulation and vocal quality. To address these issues, we explore a range of techniques, including pitch manipulation, phoneme replacement, and advanced signal processing methods. Leveraging valuable datasets like Whitaker, UASpeech, TORGO, and DEED, we examine the development of robust Automatic Speech Recognition (ASR) and Audio-Visual Speech Recognition (AVSR) systems tailored for dysarthric speech. Additionally, we discuss feature space transformation methods to enhance speech intelligibility by modifying acoustic, articulatory, and auditory parameters. The integration of ASR, Text-to-Speech (TTS), and Voice Conversion (VC) technologies offers promising avenues for reconstructing intelligible and natural-sounding speech, empowering individuals with dysarthria to communicate effectively.

Zineb Deridj, Salah Abadli, Bessem Kaghouche: *Green Synthesis of ZnO Thin Films via Spray Pyrolysis: Electrochemical and Photocurrent Performance Analysis*

Abstract

This study presents the bio-synthesis of Zinc Oxide (ZnO) thin films using a spray pyrolysis technique with extract of Eucalyptus tree leaves as a precursor. The films were deposited onto copper substrate and characterized to investigate their structural, morphological, and electrochemical properties. Atomic Force Microscopy (AFM) revealed a uniform and well-dispersed ZnO layer across the surface of the electrode, while Scanning Electron Microscopy (SEM) analysis indicated the presence of a lamellar structure in the ZnO film. The electrochemical performance of the ZnO thin films was evaluated in a 0.1 M KCl electrolyte solution. The interface has been modeled using an equivalent circuit comprising of a parallel charge transfer resistance RCT and a constant phase element (CPE) in series with a resistance of electrolyte RS. Through capacitance measurements and Mott Schottky analysis provided insights into the semiconductor–electrolyte interface by varying applied dc potential and frequency. Moreover, the carrier concentrations ND and flat band potentials Vfb of the sample were obtained by Mott-Schottky analysis. Furthermore, the photoelectrochemical performance of ZnO thin film was assessed and indicated that the maximum photocurrent density (9.041 mA/cm2) under light illumination, highlighting their excellent photocurrent transmission capabilities.

==========

Messaoud Zobeidi: *FACTS-Based Solutions for Overload Mitigation and Voltage Regulation in Modern Power Systems*

Abstract

Abstract—The growing demand for electrical energy has led to increased complexity in power generation and transmission systems, necessitating more effective and economical methods of operation. This paper addresses these challenges by leveraging Flexible Alternating Current Transmission System (FACTS) devices, which enhance the performance and control of power systems. Specifically, it introduces a novel sensitivity analysis-based method to identify the optimal placement of Thyristor Controlled Series Capacitors (TCSCs) and Static VAR Compensators (SVCs). The proposed approach is validated on IEEE 14-bus and IEEE 30-bus systems using Power World Simulator (version 18 Education), demonstrating its effectiveness in improving system stability and reducing power losses.

==========

Hamza Semmari, Nada Erraihane Hebbaz, Yamina Issaad, Daniela Blessent, Abdelkader Filali: *Validation of Mathematical Models of Alkaline and Proton Exchange Membrane (PEM) Electrolyzers with Literature Experimental Data*

Abstract

This article presents a validation of mathematical models against literature experimental data for alkaline and Proton Exchange Membrane (PEM) electrolyzers. The validation concerns also an Aspen HYSYS alkaline model expected for future large scale application. The validation demonstrated that simulated outputs closely aligned with theoretical values under various operating conditions, confirming the reliability of these models in predicting electrolyzer performance. This successful validation supports their application in the design and optimization of green hydrogen production systems.

Assala Nacef, Djamila Mechta, Lina Benchikh, Lemia Louail, Rahma Berchi: *Simulated Annealing Approach for Producer Subset Optimization in Smart Grids*

Abstract

Energy routing in smart grids is a critical process for optimizing the distribution of electrical power from multiple producers to a diverse set of consumers. Unlike traditional power grids, smart grids incorporate real-time data, advanced control systems, and distributed generation resources, enabling dynamic adjustments to energy flow. Energy routing in this context aims to achieve efficient energy transfer by selecting the optimal paths that minimize power loss, maximize transmission efficiency, and balance supply-demand conditions. A key challenge in energy routing is determining the optimal subset of producers for each consumer. This paper presents a scalable routing protocol utilizing the simulated annealing optimization algorithm. Simulations demonstrate the protocol's effectiveness and efficiency, particularly when compared to current approaches. This research marks a significant step forward in improving smart grid management within today's evolving energy landscape.

==========

Kaddour Gherfi, Abdelmalek Bouguettaya, Yazid Laib dit Leksir, Zoheir Mentouri: *Application of VGG-16 and Modified VGG-16 for Railway Fault Classification Using Image Datasets*

Abstract

Railway accidents, despite safety measures, remain a significant concern, stemming from collisions, or derailments due to technical defects (rolling stock failure, rails degradation, safety systems malfunction), and external factors like terrain movements or obstructions. Such events have severe consequences, including injuries, fatalities, transportation disruptions, and environmental damage. This study focuses on enhancing railway safety by detecting and classifiying rail flaws through advanced image analysis techniques. We investigate four different approaches, including VGG-16 with and without data augmentation, a modified VGG-16 architecture with and without data augmentation, our results demonstrate that the modified VGG-16 architecture with data augmentation achieves the highest classification accuracy of 94.11%, surpassing the performance of the other methods. This research highlights the potential of tailored deep learning models and data augmentation techniques in achieving efficient and accurate defect detection, what helps increasing this railway component reliability and improving safety improving railway safety.

==========

Lamia Ouhib, Redouane Kara: *Local Non-Quadratic Robust Tracking Control of Takagi-Sugeno Systems: A D-Stability Design*

Abstract

This study focuses on the synthesis of robust tracking control for nonlinear systems characterized by uncertain and disturbed Takagi-Sugeno multiple models, integrating D-stability constraints with L2-gain performance. D-stability is ensured by confining the closed-loop eigenvalues within a predefined LMI region, while L2-gain analysis reduces the impact of model uncertainties and external disturbances. To this end, relaxed sufficient LMI conditions based on a poly-quadratic fuzzy Lyapunov function are derived. The proposed approach is validated through a simulation of an inverted pendulum system.

Wafa Bakhat, Asma Benchiheb, Hamza Lidjici, Fatima Bakhat, Khadidja Rahmoun: *Impact of Doping and Temperature on Heterojunction Silicon Solar Cell Performance (ZnO/a-Si/c-Si): A Comparative Analysis Using COMSOL Multiphysics and SCAPS*

Abstract

This study investigates the effect of temperature, doping concentration and layer thickness on the performance of photovoltaic solar cells using COMSOL-Multiphysics and SCAPS programs as a means of simulation to see their performance towards these effects in the form of a comparative study between them, where we used a 1D heterogeneous solar cell (ZnO/a-Si/c-Si) We found through our analysis that in some cases SCAPS provides more stable values in some parameters, making it suitable for quick analysis without the need for complex calculations, while COMSOL shows more sensitivity to some variables such as temperature and layer thickness. If studying the effect of temperature and thin layers on performance is critical, COMSOL is more accurate in this aspect, as it gives more flexibility to model complex geometries and multiple physical interactions. Moreover, a comparison of the results obtained between COMSOL, SCAPS, and experimental results revealed that COMSOL results are more consistent with experimental results, making it a more reliable choice for modern solar cell design.

==========

ET-Tahir Zemouri, Nabil Zerrouki, Djamel Eddine Sayah: *DotWise : A deep Learning-Powered Application for Efficient Black-to-Braille Text Conversion*

Abstract

Access to information and reading materials is crucial for the empowerment and education of visually impaired individuals, and Braille serves as a vital medium for this purpose. However, the production of Braille texts is often time-consuming and expensive, limiting the availability of resources. This paper presents an innovative automatic Braille recognition and conversion system, designed to significantly reduce both the time and cost involved in producing Braille texts. By automating the conversion of standard printed text into electronic Braille, the system addresses the challenges faced in Braille production, enhancing accessibility for the visually impaired. The core of the proposed system leverages deep learning techniques, specifically the Long Short-Term Memory (LSTM) algorithm, to recognize printed characters and convert them into Braille. Experimental results demonstrate a drastic reduction in conversion time, highlighting the efficiency of the approach. This system promises to expand the availability of reading materials for visually impaired individuals, making a meaningful impact on their knowledge acquisition and overall welfare.

==========

Sabrina Mokrani, Souad Belferdi, Hichem Bencherif, Souhil Kouda, Toufik Bendib: *Numerical Simulation of Lead-Free Perovskite Using TiO2 and MgCuCrO2 as Charge Transport Material*

Abstract

In this paper, we conduct a comprehensive theoretical investigation aimed at identifying the factors limiting efficiency in lead-free double perovskite solar cells. Our study has two main objectives: first, to assess the impact of various parameters on cell performance, and second, to optimize the cell configuration to enhance efficiency. Using a double perovskite as the absorber layer, TiO_2 as the electron transport layer, and $MgCuCrO_2$ as the hole transport layer, using SCAPS 1D we analyzed the effect of Na and Nd doping on the cell's electrical parameters. The optimized cell structure achieved improved results, demonstrating its potential for lead-free photovoltaic applications and offering insights for future performance enhancement Voc of 1.496V,Jsc of 19.04mA/cm2 FF of 67.37% PCE of 19.2%.

Mokrane Hamza, Nabil Iftissen, Ahcene Abed, Mohamed Ould Zmirli: *Three-Phase Inverter Control with LC Filter Output for Uninterruptible Power Supply*

Abstract

This paper presents research on implementing predictive control for three-phase inverters with output LC filters for uninterruptible power supply (UPS) applications. The goal is to achieve high-quality voltage regulation and fast dynamic response under various load conditions, including nonlinear loads. This model predicts the future behaviour of controlled variables, such as the inverter's output voltage and current. Constraints, such as voltage and current limits, are considered in control design to ensure safe operation. The optimization problem in predictive control is solved at each control time interval, aiming to minimize the cost function while satisfying the system constraints. The cost function can be customized based on specific goals, such as reducing total harmonic distortion (THD) in the output voltage or optimizing performance. The resulting control actions will provide optimal drive for the inverter to regulate the output voltage. With MATLAB/Simulink tools, we assess the efficacy of the suggested control strategy by presenting simulation results across various linear and nonlinear loads. The results demonstrate that the feedforward control scheme produces low THD and satisfactory dynamic response.

==========

Imene Hadjadji, Leila Falek, Amina Hamza: *Multitask Learning for Emotion and Gender Recognition in Arabic Speech Using CNN-LSTM Architectures*

Abstract

This paper proposes a multitask learning framework for simultaneous emotion and gender recognition from Arabic speech. Leveraging a hybrid Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) architecture, the model captures both spectral and temporal characteristics of speech. By using Mel Frequency Cepstral Coefficients (MFCCs) as features, the model achieves an emotion classification accuracy of 86.05% and a gender classification accuracy of 97.80%. This approach provides insights into the dynamic interplay between gender and emotion in speech, highlighting how gender influences emotion recognition and vice versa. The results suggest that combining CNN-LSTM architectures for emotion and gender classification can improve performance over traditional methods, particularly for languages with underrepresented datasets like Arabic. The paper contributes a unique dataset and demonstrates the effectiveness of multitask learning in addressing the challenges of emotion and gender recognition in speech.

==========

Merzak Ferroukhi, Lina Ahmed Serier, Sabah Benzeghda: *Contribution to the Study and the Realization of Smart Glasses for the Blind using an ESP-32 CAM*

Abstract

This paper aims to examine the technologies used in smart glasses for the blind using an ESP-32-CAM which visualizes the environment of the wearer of these glasses and which allows him to meet different objects that affect him. surrounds, as well as an obstacle detector which allows it to navigate in complete safety. These smart glasses are designed to improve the independence and mobility of visually impaired people, by providing real-time audio feedback on their surroundings. This project explores the latest developments in smart aids for the blind, including their features, limitations and potential benefits and to promoting a more inclusive and accessible society.

Istighfar Chettih, Fatima Chouireb, Abdelhadi Bousaid, Youcef Betaimi: *Real-World 2D ROS-Mapping Using the Pioneer 3-DX Robot and Sick LMS5xx Sensor*

Abstract

One of the most important problems to be solved in mobile robotics is the question of where the robot is, and what the world around it looks like. This problem is known as Simultaneous Localization and Mapping (SLAM). In this paper, we investigate a real-world robotic system based on the Pioneer 3-DX mobile robot (P3DX), that relies on LiDAR sensor data to achieve accurate indoor mapping when GPS data are unavailable. Hence, we implemented the Gmapping-SLAM algorithm within the Robot Operating System (ROS) framework, where we tested it across challenging environments. Moreover, various ROS packages were installed and the sensor was configured to provide a useful tutorial for implementing the system appropriately. Furthermore, to assess the performance of our tests, we first investigated Gazebo simulation, then our real-world experimental scenario was performed via the P3DX robot equipped with the Sick LMS5xx LiDAR sensor.

==========

Mohammed Bouladame, Souad Tobbeche: *High-Efficiency Single and Double Perovskite Solar Cells FAPb(I1-xBrx)3-Based Numerical Simulation using Silvaco-TCAD*

Abstract

The main goal of this research is to design single perovskite solar cells (SPSCs) and double perovskite solar cells (DPSCs). Despite limited research time, organic-inorganic SPSCs and DPSCs have achieved remarkable efficiency. Single and double perovskite solar cells based on forma midinium ($FAPb(I_{1-x}Br_x)_3$) have emerged as promising candidates for organic-inorganic PSCs. The performance of DPSCs is significantly influenced by the electron and hole transport layer (ETL and HTL). FTO/TiO2/FAPbI3/SpiroOMeTAD/Au, FTO/TiO2/FAPbBr2I/Spiro-OMeTAD/Au, and FTO/TiO2/FAPbI3/FAPbBr2I/Spiro-OMeTAD/Au were the structures of the three devices examined in this study. Here, we use Silvaco Tcad to examine the impact of different thickness values to achieve highly efficient SPSCs and DPSCs based on FAPb (I1-xBrx)3. TiO2 was used as the ETL and Spiro-OMeTAD as the HTL. To determine the highest power conversion efficiency (PCE), three cells in total were examined. At 37.44%, the cell with the highest efficiency had two active layers.

==========

Hamza Gasmi, Tahar Tafticht: *Performance Enhancement of DFIG Based Wind Energy System Using PSO-SOSMC Algorithm*

Abstract

The research focuses on developing and simulating a wind power system (WPS) with a doubly-fed induction generator (DFIG). Two second-order sliding mode controllers (SOSMC) are employed to minimize active and reactive power and current ripples, ensuring stable power injection into the grid. Unlike traditional sliding mode controllers, the SOSMC offers greater robustness and effectively reduces the chattering effect caused by the SMC's discontinuous control. Its advantages include simplicity, ease of use, robustness, and quick response. The particle swarm optimization (PSO) algorithm is utilized to optimize the SOSMC parameters, enhancing its performance. MATLAB simulations confirm the proposed method's success in reducing chattering and achieving precise control of DFIG-generated WP.

Mahfoud Aliouat, Mohamed Djendi: *Real-Time Voice Activity Detection using Hybrid Deep Learning Models with a Multi-Noise Detector*

Abstract

In this study, we present a novel voice activity detection (VAD) system leveraging deep learning techniques to enhance speech detection in noisy environments. Traditional approaches, such as energy-based methods and SNR estimation, have been widely employed to address challenges in speech applications. However, recent advancements in artificial intelligence and the availability of extensive datasets have enabled more robust solutions for speech enhancement and noise reduction. The proposed system incorporates a two-stage architecture. In the first stage, a Bi-LSTM-based noise detection model is utilized to identify the type of noise present. The second stage employs a set of noise-specific VAD models built on hybrid BiLSTM-GRU architecture, tailored to maintain high performance across various acoustic environments. The system was evaluated using multiple performance metrics, including accuracy, F1 score, and recall, under diverse noise types and signal-to-noise ratio (SNR) levels. Results demonstrate that the Bi-LSTM-GRU model outperforms existing methods, achieving superior accuracy across all noise conditions. Notably, for Volvo noise, the model achieved an F1 score of 97.92% and a recall of 98.44%, indicating its ability to effectively handle complex noisy environments. These findings highlight the resilience of the proposed system in accurately detecting voice activity across a wide range of noise types and intensities, offering promising potential for real-world applications in communication systems, industrial settings, and beyond.

==========

Souad Ksenna, Mohamed Lamine Talbi, Rania Saoudi: *Improving Pneumonia Detection in Chest X-Rays: A VGG-16 Framework with Fractional Order Optimization*

Abstract

Imaging the chest using X-rays, commonly referred to as a Chest X-ray (CXR), is essential for identifying and tracking pneumonia and various lung conditions. However, classification frameworks designed to analyze CXR images must be robust enough to handle the complexity and variability present in medical imaging data. In this study, we propose a novel pneumonia detection framework that integrates the Fractional Order Adam (FOAdam) optimizer with the VGG-16 architecture, utilizing advanced optimization techniques based on fractional calculus. By implementing dynamic fractional order scheduling through the Fractional Order Scheduler (FOS), our approach enhances convergence and generalization, effectively addressing the limitations of traditional optimizers such as Stochastic Gradient Descent (SGD) and Adam. Extensive experiments conducted on a publicly available CXR dataset demonstrate the superiority of our method, resulting in significant improvements in accuracy, precision, F1-score, and Matthews Correlation Coefficient (MCC). Specifically, our method achieved an accuracy of 92.60%, a precision of 91.52%, an F1-score of 94.25%, and an MCC of 84.20%. These findings underscore the potential of fractional order optimization in advancing medical image classification. This study not only showcases the effectiveness of FOS-FOAdam in binary classification tasks but also establishes a foundation for applying fractional calculus to a wider range of medical imaging challenges, paving the way for improved diagnostic tools in healthcare.

Yasmine Saidi, Fethi Demim, Aimen Abdelhak Messaoui, Amar Benghezal, Ali Zakaria Messaoui, Abdennour Seghier, Farouk Kalla, Abdenebi Rouigueb, Abdelkrim Nemra: *Enhanced Real-Time Path Planning using Nonlinear Control for Unmanned Ground Vehicles*

Abstract

This study presents a comprehensive trajectory planning approach tailored for mobile robots. The primary objective is to achieve robust stability and real-time tracking of reference trajectories, with particular attention to maintaining dynamic stability limits and addressing disturbances encountered during trajectory execution. The proposed method leverages a potential field algorithm to enable precise trajectory tracking while ensuring effective obstacle avoidance. To validate the effectiveness of the approach, a series of experiments were conducted under realistic and dynamic conditions using the QBot-2e mobile robot. These experiments demonstrated the capability of the proposed method to achieve high-accuracy trajectory tracking, even in the presence of external disturbances. Additionally, the method's adaptability to varying environments and its ability to maintain safe navigation paths further highlight its potential for real-world applications.

==========

Lamine Medekhel, Chouaib Labiod, Kamel Srairi, Zahir Koufache, Mohamed Toufik Benchouia, Mohamed Benbouzid: *Mitigating the Ni-Cd Batteries Memory Effect: A Case Study of the Turbine Engine Emergency Lube Oil System*

Abstract

This paper addresses the challenges associated with the memory effect in Nickel-Cadmium (Ni-Cd) batteries, particularly in critical applications such as turbine engine emergency lube oil systems. These systems are infrequently operated, which limits the regular discharge of the batteries over extended periods, thereby intensifying the memory effect and significantly diminishing their capacity. Initial tests revealed that the batteries delivered only 50% of their nominal capacity as a result of this phenomenon. To address the memory effect, an approach involving periodic charge and discharge systematically cycles was proposed and implemented. The effectiveness of this method was validated through a second autonomy test, during which the batteries successfully regained their nominal capacity. This approach offers a practical and efficient solution for ensuring the reliability and optimal performance of Ni-Cd batteries in emergency systems, where failure could lead to severe consequences, such as engine damage.

==========

Sonia Salhi, Sid Ahmed Tedjini, Abdelhalim Slimane : *1V Bandgap Voltage Circuit Design in CMOS 65nm Technology*

Abstract

Paper presents a design methodology for a high precision bandgap reference voltage circuit designed in 65 nmCMOS technology. The proposed structure achieves a nominal output voltage of 1 V with a low temperature coefficient of11.89 ppm/°C, ensuring stability across a temperature range from 0-100 °C. Key performance metrics include a power supply rejection ratio of -51 dB and robust operation over a supply voltage range of 1.6-2.5 V, making it suitable for power management in low energy-harvesting applications.

Sabrina Difallah, Mokhtar Attari: *Nonlinearity Issues in Respiratory Flow Measurement in Constant Temperature Mode*

Abstract

Accurate respiratory flow rate measurement is critical for optimizing mechanical ventilation, a life-support intervention widely used in Intensive Care Units (ICUs). A precise monitoring is required to deliver the right amount of gas to patients, however, conventional sensor designs that patients often face cost and complexity barriers. For this purpose, Hot Wire Anemometers (HWAs) are particularly well-suited as they offer high sensitivity, and fast response. This paper presents the development of a cost-effective thermal flow meter leveraging a Negative Temperature Coefficient (NTC) thermistor as a sensing element, operating in Constant Temperature Mode (CTM). A closed-loop control system dynamically adjusts heating current to compensate for airflow-induced thermal losses, enhancing sensitivity and stability under low-flow conditions. A custom calibration setup was implemented to validate the system's performance under controlled flow scenarios. While the inherent nonlinearity of the thermal feedback system poses challenges, the primary contribution of this work lies in investigating the causes of these nonlinear behaviors and exploring methods to mitigate their impact on flow accuracy. This system emphasizes cost reduction and adaptability for ICU use without compromising fast response or precision. By addressing these nonlinearity issues, the proposed system demonstrates its potential as an effective, low-cost solution for real-time respiratory monitoring in mechanical ventilators.

==========

Sofiane Brahami, Kaci Ghedamsi, Abdelyazid Achour, Samir Kennouche: *Finite Set Predictive Torque Control Approach of Induction Motor Fed by PWM Voltage Source Inverter*

Abstract

This paper investigates the application of finite set model predictive torque control (FS-PTC) for induction motor (IM) drives powered by pulse-width modulation voltage source inverter (PWM-VSI). Compared to traditional methods such as field-oriented control (FOC), FS-PTC offers superior dynamic performance, enhanced control precision and simplicity in handling system's nonlinearities. The proposed approach uses the system's mathematical model to calculate future behavior and solve a multi-objective cost function, enabling optimal values of the controlled variables. In order to validate its effectiveness, extensive simulations were conducted in the MATLAB/Simulink environment under various operating conditions, including external disturbances, speed reversal, and parameter mismatches at low-speed operation. The findings highlight the FS-PTC's ability to provide accurate reference tracking, reduce torque ripples, and ensure robust performance despite parameter uncertainties.

==========

Mourad Drif, Yacine Boussaadia, Zineb Laieb, Mohamed Tellache, Mohamed Lamine Tounsi: *An Efficient Design of a RFID Loginer System*

Abstract

This paper presents an RFID Loginer system solution for automatic authentication enhancing user convenience and security. Designed with a 13.56 MHz RFID reader, a microcontroller, and three buttons, the system securely stores encrypted passwords using Advanced Encryption Standard (AES) in the microcontroller's EEPROM. Each button corresponds to a unique password, allowing users to access different accounts on public computers in a secure manner. The RFID Loginer system is equipped with a USB plug-and-play interface for PC connectivity, the system operates without requiring drivers or specialized software.

Assia Lombarkia, Maroua Chouhbane, Wafa Allaoua, Lotfi Djouane, Tarek Fortaki, Rahma Belkaid: *Millimeter-wave Antenna Design and Analysis for 5G Mobile Communication*

Abstract

This study presents a compact antenna designed for millimeter-wave applications in the 5G frequency range. The proposed antenna operates at a resonant frequency of 60 GHz, utilizing a 50 Ω microstrip-line feeding technique. The antenna is printed on a Rogers RT5880 substrate with a relative permittivity of 2.2, a loss tangent of 0.0009, and dimensions of 4.6×3.6×0.25 mm3. Results indicate a minimum return loss of -13.31 dB, a gain of 4.28 dBi at 60 GHz, and a bandwidth of 7.69 GHz. Array antenna with 4 element with 2.5 mm spacing has been proposed to achieve 11.6 dBi gain for mobile data applications on millimeter wave frequencies range from 46.61 GHz to 63.47 GHz and 71.11 GHz with bandwidth of 16.86 GHz and 3.39 GHz respectively. Overall size of the antenna is 8×12×0.25 mm3. The proposed antenna offers several advantages, including a broad bandwidth, high gain, improved efficiency, compact size, low profile, and a simple structure.

==========

Naima Zerari, Hassen Bouzgou, Christian A. Gueymard, Christian Raymond: *Feature Selection using Select-k-Best Approach with Support Vector Regression to Estimate Ultraviolet Irradiance from Solar Radiation Data*

Abstract

Terrestrial ultraviolet (UV) radiation is a significant factor that impacts the long-term reliability and durability of photovoltaic (PV) modules. This study introduces a two-step model designed to estimate the UV irradiance in six different wavebands based on broadband global horizontal irradiance and various atmospheric quantities. The model utilizes a large look-up table of spectral data generated by the SMARTS radiation model under diverse atmospheric conditions and solar positions. The first step involves selecting the most important features for optimal prediction performance using the k-Best selection approach. The selected optimal subset is then used as input to the Support Vector Regression (SVR) prediction technique. The results demonstrate strong prediction accuracy for all UV wavebands, particularly in the UV-A band.

==========

Haithem Mekhermeche, Mustapha Aouache, Abdelhamid Iratni, Abderraouf Seniguer: *Thermal Breast Cancer Screening via Auto-ROI Asymmetry Segmentation and Classification*

Abstract

Breast cancer is a leading cause of mortality among women, making early detection crucial for survival rates. Thermography, a non-invasive technique, shows promise for early screening by analyzing temperature asymmetries between breast regions. However, precise segmentation of Regions of Interest (ROIs) in thermograms is essential for classification accuracy. This paper presents a fully automated method for segmenting thermograms using a Convolutional-Deconvolutional Neural Network (C-DCNN) and right-left breast segmentation for asymmetry analysis. Followed by examining Support Vector Machine (SVM), K-Nearest Neighbors (KNN), and Random Forest to assess breast health. Experimental results demonstrate competitive segmentation accuracy, with SVM outperforming other classifiers. This study underscores the effectiveness of integrating deep learning with traditional machine learning in breast cancer diagnosis, paving the way for more accurate automated methods.

Chaima Bensaid: *Machine Learning Techniques for SinkHole Attack Prediction in IoTs*

Abstract

Sinkhole nodes attempt to falsify source-destination routes in order to attract network traffic using the AOMDV routing protocol. They accomplish this by altering routing control packets so that they publish erroneous routing information, which makes sinkhole nodes seem like the most efficient way to get to particular locations. Routing security has always been a challenge, especially when it comes to detecting and preventing active attacks. SinkHole attacks threaten the network by preventing data availability. In this paper, the main objective is to evaluate the performance of various state-of-the-art classifiers, such as ML Na¨ıve Bayes (NB), K-Nearest Neighbors (KNN), Artificial Neural Network (ANN) algorithms, to accurately detect SinkHole attacks. Our detection model achieved an accuracy of 95.2%, 89.3% and 97.1% respectively for the KNN, SVM and ANN-based models. Detecting attacks using machine learning involves training a model to recognize patterns associated with such attacks, then using the model to classify incoming network traffic as normal or potentially malicious. It is important to note that machine learning models for detecting SinkHole attacks should be part of an overall cybersecurity strategy, and not the only method of defense.

==========

Fatiha Mokdad, Lina Ameur, Seloua Chouaf: *Enhanced Kinship Verification with Joint Color-Texture Features*

Abstract

Facial kinship verification, the process that determines whether or not a family relationship exists based on the analysis of facial images, is a subject of growing interest due to the diversity and the importance of its practical applications. This work explores an approach to kinship verification that uses a feature extraction technique called the Histogram of Local Binary Patterns (Hist LBP). The Hist LBP provides a richer representation of facial features by capturing both texture and color information. This study also investigates the effect of a power transform normalization technique, applied to the extracted features. The normalized Hist LBP features are then fed into a Support Vector Machine (SVM) classifier, trained using 5-fold cross-validation for robust model training and evaluation. The system's performance was evaluated on the KinFaceW-II benchmark, achieving an accuracy of 91.15 % with the optimal parameter configuration. This result is considered promising compared to many state-of-the-art approaches.

==========

Aouda Bounif, Fadhela Fodhil, Meriem Zoulikha: *A Comparative Study of Deep Learning Architectures for Photovoltaic Panel Defect Detection*

Abstract

This study assesses the performance of four deep learning models—AlexNet, ResNet50, VGG16, and Vision Transformer (ViT)—for classifying defects in solar panels, including bird droppings, dust, snow cover, and physical or electrical damage. Trained and tested on a dataset of 891 images, the models were evaluated for accuracy, computational efficiency, and interpretability. The findings reveal the strengths and limitations of each model, with ViT demonstrating superior ability to capture complex image patterns through its self-attention mechanism. This suggests that transformer-based models, particularly ViT, offer significant advantages for detecting defects in solar panels.

Wafa Derouaz, Thouraya Merazi Meksen: *Rapid Learning for Efficient Audio Acquisition in Constrained Environment*

Abstract

We propose an efficient audio acquisition scheme for constrained sensing environments based on Compressed Sensing (CS). Dictionary learning methods are designed to improve sparse representation, thereby enhancing the quality of the reconstructed signal from compressed sensing samples. Existing approaches generally involve a sparse coding stage that is computationally intensive, resulting in a time-consuming training process. In this work, we propose a fast dictionary learning scheme. First, a rapid and accurate voice activity detection module is employed to categorize the training data into two separate databases: one for voiced signals and one for unvoiced signals. Then, for each class, a labeled dictionary is learned using a greedy adaptive method that focuses only on the sparsity of the dictionary and avoids sparse coding techniques. Finally, a decision block is designed to determine whether the dictionary is voiced or unvoiced for the recovery stage of the compressive sensing procedure. Evaluation results show that the proposed method can achieve good performance in terms of several objective measures, including perceptual evaluation of speech quality (PESQ), short-time objective intelligibility (STOI), and segmental signal-to-noise ratio (SSNR), especially in noisy conditions. Overall findings highlight the merit of our presented system in terms of signal quality, learning speed, and efficient dictionary storage.

==========

Badis Lekouaghet, Walid Merrouche, Mohammed Haddad: *Precise Parameter Identification of Lithium-ion Battery Models for Electric Vehicle Applications*

Abstract

Lithium-ion batteries (LiBs) have become the leading choice for energy storage systems (ESS) in electric vehicles (EVs) due to their superior performance characteristics. However, their sensitivity compared to other battery technologies necessitates the use of advanced battery management systems (BMS) for reliable and safe operation. Accurate parameter identification for LiBs is essential to assess the performance of energy storage systems within BMSs and EVs. This research explores the Fully Informed Search Algorithm (FISA), a novel optimization method, to determine the parameters of 2nd and 3rd order equivalent circuit models (ECM) for LiBs. As an enhanced version of the Rao algorithm, FISA is recognized for its efficiency in tackling real-world optimization problems while maintaining the simplicity and parameter-free nature of its predecessor. The study focuses on minimizing the error between the ECM-predicted voltage and the actual battery voltage measurements. To validate the proposed approach, a high dynamic profile (HDP) is employed, alongside a comparative analysis of FISA and the Rao algorithm. The simulation results demonstrate that FISA achieves highly accurate and stable parameter estimation, surpassing the precision of the Rao method. Moreover, findings indicate that the 3rd order ECM provides superior accuracy in capturing the parameters of the battery model.

Souad Belferdi, Sabrina Mokrani, Mohamed Amir Abdi, Hichem Bencherif: *Efficiency Enhancement of Double Perovskite Solar Cell a Numerical Study Using Scaps 1D*

Abstract

This work provides thorough theoretical analysis that is designed to identify the factors that hindered the efficiency of double perovskite solar cells. The objective of our investigation is to evaluate the influence of a variety of parameters on the efficacy of this design and to improve its performance. The optimized design surpasses the baseline, achieving a JSC of 20.57 mA/cm2, Voc of 1.11 V, and FF of 72.20%. This suggests that the strategic optimization of double perovskite solar cell attributes has the potential to achieve an efficiency of up to 16.63%. The proposed analysis enables the identification of the variables accountable for degradation and establishes a foundation for additional design optimization.

==========

Nabila Nouar: *Simulation and Performance Analysis of New Logarithm-based CFAR Processors in Compound Gaussian Clutter*

Abstract

This paper addresses Constant False Alarm Rate (CFAR) detection in compound Gaussian clutter. The proposed detectors, namely: Logarithmic Cell Averaging Greatest of CFAR (Log CAGO-CFAR) and Logarithmic Cell Averaging Smallest of CFAR (Log CASO-CFAR) are based on estimating the clutter's texture component from the leading and the lagging windows that surround the cell under test (CUT) by computing the mean of the Logarithms of clutter samples of each window, then selecting the Maximum (GO) and the Minimum (SO) respectively. Clutter levels are evaluated by taking the exponential of the Logarithms in order to convert the estimators to the intensity domain. The latter is multiplied by a constant threshold factor in order to maintain a constant Probability of False Alarm (Pfa), the product is compared to the CUT as part of the decision rule. Expressions of the Logarithmic estimation are derived for each detector from clutter samples vectors. Detection schemes and expressions of decision rules are also presented. Detection performances of both detectors are analyzed by means of Monte Carlo simulations considering various parameters such as: reference window size, correlation coefficient and (Pfa).

==========

Salah Ben Aoua, Farid Mechighel: *Lattice Boltzmann Modelisation of Natural Convection in Electronic Cooling: Analysis of Partially Bottom-Heated Square Cavities*

Abstract

In this work, the lattice Boltzmann method (LBM) is used to simulate a thermal flow problem in a two- dimensional (2D) enclosed cavity. Filled with air, the Prandtl number is Pr=0.71, partially heated bellow subjected to fixed heated boundary with temperature TH which represent an electronic device, where the rest portions of the bottom wall are insulated, either the upper wall of the cavity is insulated. The length of heated segment variation is (0.2 to 0.8) of the total wide, both lateral boundaries are held under cold isothermal conditions with temperature TC. The mesoscopic D2Q9 lattice configuration with the Bhatnagar Gross Krook (BGK) model is used; we analyzed the influence of heat source segment variations E in the range of Rayleigh number between (103 and 106). The streamlines, isotherms, and temperature profiles are presented. However, a positive correlation is observed between heated segment length and thermal transport phenomena. Results show a good agreement with previous study, this analysis shows that various portions of heating from the bottom and the Rayleigh number (Ra) influence the dynamic and thermal field.

Abdelafattah Hoggui, Ali Benachour, Khoutir Benkouachi, Mohamed Chafaa, Mohand Oulhadj Mahmoudi: *Direct Torque Control (DTC) Implementation for Five-Phase Induction Motors*

Abstract

This paper explores the study and implementation of the widely recognized Direct Torque Control (DTC) applied to a five-phase induction motor fed by a two-level, five-phase voltage source inverter. Five-phase systems offer significant advantages over traditional three-phase counterparts, such as enhanced fault tolerance, higher torque density, and reduced harmonic distortion, making them ideal for high-performance applications. DTC is a direct control method that eliminates the need for a voltage modulator, enabling precise and efficient control of the motor. The DTC scheme is designed and evaluated through experimental testing, focusing on key electromagnetic and electrical parameters, such as speed reference tracking, torque ripple, and current harmonics, under dynamic and steady-state conditions. The results highlight DTC's ability to achieve superior control accuracy and robustness across various operating conditions, providing valuable insights for adapting and optimizing control strategies traditionally effective in three-phase systems for application in multiphase motor systems.

==========

Bahia Yahya-Zoubir, Fatiha Mokdad, Karima Ait Sadi: *Local Grouped Order Pattern and Non-local Binary Pattern for Face Spoofing Detection*

Abstract

Face spoofing detection is an area of research which focuses on improving the security of facial recognition systems. It's a cybersecurity strategy that prevents facial recognition systems from being fooled by fraudulent access. In this paper, a new face spoofing detection pipeline is proposed based on the extraction of Local Grouped Order Pattern and Non-local Binary Pattern (LGONBP) texture descriptors from the HSV color space channels. The LGONBP features are extracted separately from the three channels of the HSV face image, the three resulting texture descriptions are concatenated and fed to an SVM classifier. The proposed method is evaluated on the publicly available MSU-MFSD database, the obtained results show competitive performance compared to the existing face spoofing detection techniques.

==========

Sarah Younsi, Amirouche Nait Seghir, Rabea Guedouani: *Harnessing Deep Learning for Enhanced Energy Consumption Forecasting in smart Home: A comparative Study of MLP and RNN Architectures*

Abstract

Each country is looking for effective ways of reducing energy consumption in residential sectors. The process needs close monitoring to comprehend energy usage trends. It is, therefore, important to predict energy consumption in households that will help in formulating efficient ways of optimization and adjustment of energy utilization. The major motivation of this paper is to provide deep learning-based advanced models that would enable the forecasting of household energy consumption with regard to different weather factors. In pursuit of this, we set out to develop a collection of deep learning models Multilayer Perceptron (MLP) and Recurrent Neural Networks (RNN) to evaluate the respective strengths of both the above-named models. The goal is to achieve highly accurate predictions. We evaluated the performance of the MLP and RNN prediction models based on their RMSE scores; the proposed models achieve a lower value of RMSE. Both models correctly recreated the consumption curves with exceptional accuracy.

Mohammed Amine Zafrane, Houari Aoued, Adda Adel Belharzam: *A Modular Approach to Gas Monitoring: Design and Implementation with SCADA Integration*

Abstract

This article presents the design and development of a gas acquisition and control system utilizing the PIC16F877 microcontroller in conjunction with an MQ2 gas sensor and a Type K thermocouple for temperature measurement. The primary objective is to offer a reliable and cost-effective industrial solution for local gas detection and management. The development process followed a structured methodology comprising several key phases. Initially, simulations were performed to evaluate the system's technical feasibility and behavior before proceeding to hardware implementation. Experimental testing on dedicated test boards was then conducted to verify the functionality of each individual component. Emphasis was placed on modular integration, culminating in the creation of a compact and optimized electronic module using professional PCB design software. A notable innovation of this project is its scalability. Beyond hardware development, integration with a SCADA system was proposed to enable centralized monitoring and control, thereby enhancing industrial applicability and alignment with modern automation frameworks. This proposal was implemented and validated at a gas bottle filling site in Algeria, demonstrating its practical relevance and effectiveness in a real-world industrial environment.

==========

Houari Aoued, Mohammed Amine Zafrane, Ismail Abaidi, Houria Salem, Adda Adel Belherzaem, Youssouf Meddahi: *Electronic Design and Modal Analysis of Inertial Measurement Unit for UAV Missions*

Abstract

Unmanned Aerial Vehicles (UAVs) consist of diverse electronic and mechanical subsystems, with electronic subsystems commonly implemented on printed circuit boards (PCBs) housed within mechanical enclosures. These PCBs incorporate essential components such as sensors, power circuits, and modules for signal adaptation and conditioning, forming the backbone of the embedded system. UAVs are subject to various mechanical loads during operation, including shocks, vibrations, and acoustic stresses. Gaining a comprehensive understanding of the dynamic behavior of these systems is essential for design engineers to optimize mechanical structures, fine-tune embedded system specifications, and improve durability under extreme vibrational conditions. The development of a PCB for a drone represents a pivotal step in creating lightweight and efficient embedded systems that adhere to stringent robustness and reliability standards. This work integrates key phases, ranging from the electronic design for the inertial measurement unit to the structural and vibrational analysis of the board, ensuring optimal performance and resilience in challenging operational environments.

Meriem Fedila, Fatiha Mokdad, Karima Ait Sadi, Naima El-Kateb: *Modified Heterogeneous Auto-Similarities of Characteristic for Voice Spoofing Attack Detection*

Abstract

Voice spoofing detection is a critical research area due to the increasing reliance on Automatic Speaker Verification (ASV) systems in security-sensitive applications. To address this issue, recent research has focused on developing effective countermeasures to differentiate between genuine and spoofed speech. This study proposes a novel approach to voice spoofing detection using spectrogram image, with an emphasis on enhancing lowlevel features of the Heterogeneous Auto-Similarities of Characteristic (HASC) descriptor. The main novelty is to integrate a binary code image extracted from the Binary Similarity Image Features (BSIF) descriptor as an additive low-level parameter, to form a new texture descriptor, namely, modified Heterogeneous Auto-Similarities of Characteristic (mHASC). The integration of BSIF allows the model to capture finer local texture details within spectrogram images, addressing the limitations of HASC in detecting fine distinctions between bona fide and spoofed speech. Evaluation in the ASVspoof 2017 v2.0 dataset demonstrates that the proposed mHASC-based countermeasure system significantly outperforms the CQCC-GMM baseline, achieving Equal-Error Rates (EER) of 8.22% and 15.70% on the development and evaluation sets, respectively.

==========

Fatima Zohra Bouchibane, El Hocine Boutellaa, Hakim Tayakout, Sara Bouazabia, Rahma Cherigui: *A Binary Relevance Approach for Smart Antenna Selection in Massive MIMO System*

Abstract

Future transceivers are projected to incorporate massive antenna arrays, which could significantly increase power consumption. To mitigate this challenge, antenna selection technique (AS) emerges as a viable solution. By strategically selecting a subset of antennas, the system power consumption can be significantly reduced without compromising the overall system performance. This paper proposes a novel AS approach for massive MIMO systems under real-world channel measurements. By employing the binary relevance technique (BR), a straight- forward approach to multi-label (ML) learning that tackles the problem by treating each class label as an independent binary classification task, we formulate the AS problem as a ML classification task. We conducted simulations using SVM as the base learning algorithm to assess the performance of our proposed approach and compare results to the Multi Label convolutional neural network (ML-CNN) and convex relaxation based approaches. The binary relevance based SVM (SVM-BR) performance, while slightly below the suboptimal convex relaxation approach in term of system capacity, remains competitive with the MLCNN under different antenna array configurations.

Choumeyssa Chennouf, Idris Messaoudene, Massinissa Belazzoug, Youcef Braham Chaouche, Aicha Gherbi, Boualam Hammache, Salem Titouni: *Low Mutual Coupling for DRA-based Massive MIMO Antenna Arrays by Using Decoupling Cavity*

Abstract

Mutual decoupling in massive MIMO (Multiple-Input Multiple-Output) antenna systems is crucial for enhancing performance, particularly in advanced communication applications of the next generation. In this study, we propose a dielectric resonator antenna (DRA)-based massive MIMO antenna that incorporates decoupling cavities (DC) to improve isolation between elements, ensuring efficient operation at the 5 GHz frequency band. The proposed design utilizes a cylindrical DRA-based massive MIMO antenna, combined with a seamlessly integrated DC structure composed of three layered levels, positioned above the reference massive MIMO antenna array. The DC is made of an FR-4 board, with air cavities engraved into it. Simulation results demonstrate that integrating a DRA-based mMIMO antenna with DC significantly reduces coupling between array elements, from -17 dB to -30 dB, increases the bandwidth to 1200 MHz, improves the envelope correlation coefficient (ECC) and diversity gain, and enhances the radiation pattern in the E-plane.

==========

Amel Mecelti, Houria Triki: *Dynamics of Localized Pulses in Inhomogeneous Optical Fibers*

Abstract

We investigate the self-similar propagation of light pulses inside an inhomogeneous nonlinear fiber with spatially inhomogeneous cubic-quintic nonlinearity, group velocity dispersion, and gain or loss. Localized wave solutions, which propagate self-similarly in the system, are derived. The solutions include gray and kink self-similar solitons. It is shown that these waveforms exhibit a quadratic phase structure, which leads to chirped self-similar pulses. In addition, we determine the constraint conditions among the gain or loss distribution and nonlinearity, which provide the required conditions for controlling the self-similar wave dynamics. Moreover, we discuss the dynamical evolution of the self-similar pulses under the influence of special nonlinearity profiles, which are of physical importance in practical applications. The results show that through selecting the appropriate profiles of the system parameters, we can control the dynamics of similaritons effectively.

==========

Ridha Ilyas Bendjillali, Miloud Kamline, Mohamed Sofiane, Bendelhoum, Ali Abderrazak Tadjeddine, Imane Haouam, Linda Bellal: *Optimizing Arabic Handwriting Recognition using Deep Learning and the Aquila Optimizer*

Abstract

Arabic handwritten characters are crucial in various applications, necessitating highly effective recognition systems. This research presents a novel approach to Arabic Handwritten Recognition (AHR) by leveraging non-segmented techniques. The study utilizes the Aquila Optimizer to enhance the architectures of ConvNeXt and NfNet-F5 deep convolutional neural networks (CNNs), optimizing feature extraction and classification processes. Using the HACDB database, we demonstrate the effectiveness of our method, highlighting significant improvements over existing approaches. Notably, the optimized ConvNeXt architecture achieved an impressive accuracy rate of 98.96%, underscoring the robustness of our approach.

Linda Bellal, Ridha Ilyas Bendjillali, Mohamed Sofiane Bendelhoum: *Hybrid Classification Approach of Thyroid Cancer Histological Images using Deep Feature Extraction and Classical Classifiers*

Abstract

Thyroid tumors present a common clinical challenge, often requiring histological analysis for accurate diagnosis. In this study, we performed the classification of thyroid tumors using a real database of histological images. We studied the efficiency of the classification of three pathologies (medullary carcinoma, papillary carcinoma, and vesicular carcinoma) by hybrid approach combining deep feature extraction with a pre-trained Convolutional Neural Network model (with the choice of EfficientNetB0 or Mobile Net) and the final classification by a classic model (with the particular choice of Support Vector Machine or Random Forest). For this, different combinations are explored, through different metrics of performance. Each model provided very satisfactory results, the best value being that of theEfficientNetB0& SVM combination with an overall accuracy of99%. The results suggest that such a proposed hybrid approach effectively captured the discriminative features of the studied cancers of the thyroid, making it a potential high-performance computer-assisted diagnosis in thyroid pathologies.

==========

Hadj Abdelkader Benzater, Hamza Zeraoula, Chellali Slimani, Abdellatif Rouabah, Sami Baguigui: *Improving Log-t CFAR Detector Performance in Weibull Clutter under Severe Interference Conditions*

Abstract

In radar signal processing, maintaining a constant false alarm rate (CFAR) is essential for reliable target detection in varying environmental conditions. This paper introduces an improvement to the Log-t CFAR detector, known for its effectiveness in homogeneous clutter modeled by a Weibull distribution, guaranteeing a constant false alarm rate in different scenarios. However, its performance degrades considerably in the presence of interfering targets. To overcome this limitation, we propose a new architecture called the TM Log-t CFAR detector. Which incorporates the strong interference handling abilities of the TM CFAR detector into the Log-t framework. The proposed architecture has been extensively evaluated, and has shown a significant efficiency to maintain a constant false alarm rate under various clutter conditions and interference scenarios. In addition, it achieves an enhanced probability of detection, significantly improving radar detection performance in different environmental situations. The TM Log-t CFAR detector offers a promising solution for improving the reliability and efficiency of radar systems in difficult detection environments.

==========

Abderrahim Benhamou, Mohamed Tellache: *Multi-band Rectenna Based on Metamaterial*

Abstract

In this article, we examine the design and implementation of a rectifying antenna (Rectenna) for ambient electromagnetic energy harvesting, utilizing metamaterial technology. The antenna is designed to operate in the frequency bands of 2.1 GHz, 2.6 GHz, the GSM band at 1.8 GHz, and the ISM band at 2.45 GHz. Printed on a FR4 substrate with a thickness of 1.57 mm, it is based on a CSRR structure, enabling dimensional optimization and multiband resonance. To maximize energy harvesting, a rectification circuit using Schottky diodes is integrated, along with an impedance matching circuit to ensure optimal coupling between the antenna and the rectifier across the targeted frequency bands.

Ahmed Lahmissi, Mohamed Lamine Tounsi: *A New Design of a Circularly polarized Microstrip Patch Antenna Array for 5G Communication Systems*

Abstract

in this paper, a new microstrip circular polarization antenna array is designed fabricated and tested for 5G applications. The structure is based on an array of four rectangular patches geometrically placed and fed following specific 2 × 2 geometric pattern arrangement with a feeding mechanism to achieve circular polarization (CP) excitation. The antenna structure is fabricated on an FR4 substrate material, featuring a dielectric constant of 4.3, a low-loss tangent of 0.017, and a thickness of 1.6 mm. The design mainly consists of the geometric rotation of patch elements, each one fed with a 90° phase shift toward every adjacent element. The achieved axial ratio meets one to one performance over the antenna bandwidth indicating good CP performance. The proposed antenna array works at 3.5 GHz and exhibits good polarization features. The antenna array demonstrates good experimental performances in terms of high gain of 5.93 dBi, a very good return loss of -50dB at the resonant frequency 3.5 GHz and a pass-band of 117 MHz. The measurement results show good agreement with the simulations and the overall size is of 184×140 mm2. The designed antenna array is suitable for 5G applications and other future communication systems.

==========

Adda Adel Belherazem, Mohamed Amine Zaafrane, Houari Aoued, Mohamed Della krachai: *Instrumentation and Sensors Integration for Industrial Wastewater Monitoring with LabVIEW Supervision*

Abstract

This paper presents the implementation of a prototype system for acquisition and control of industrial wastewater physicochemical parameters. The main objective is to provide an efficient and cost-effective solution for environmental management in industrial facilities. A comprehensive simulation is conducted using Proteus to analyze the system's overall performance, particularly the measurement accuracy and processing capability of the ATmega328 microcontroller. The prototype incorporates several calibrated sensors, including a flow sensor, a temperature sensor, and a PH sensor to ensure precise monitoring of wastewater. Relays are included to control solenoid valves, enabling efficient automation of regulation processes. A supervision interface is developed using Labview. This interface offers real-time visualization of measured parameters evolution. An electronic board is specifically designed using the EasyEDA tool to facilitate the optimal integration of all electronic components. The board is developed and tested to verify the system's performance in real-time conditions. The proposed prototype presents an economical solution for industries aiming to monitor wastewater parameters and meet regulatory standards. The experimental results confirm the reliability and effectiveness of the proposed prototype, demonstrating its capacity to meet real-time performance requirements.

Samir Chadli, Billel Bengherbia, Karim Ben Si Said, Youcef Remram, Nazim Oudahi, Abdelmoughni Toubal: *Smart Irrigation System with Low-Power WSNs for Sustainable Water Management in Agriculture*

Abstract

As global water scarcity and agricultural demands intensify, the need for efficient irrigation systems becomes paramount. This paper presents an irrigation system utilizing a wireless sensor network (WSN) to optimize water management in agriculture. The system incorporates soil moisture, humidity, and temperature sensors connected to a Mini ESP8266 microcontrollers at the end-device nodes and ESP32 microcontrollers at the sink node. These sensors enable real-time data collection, analysis, and automated irrigation control based on environmental conditions, enhancing water conservation and crop productivity. The WSN uses the ESP-NOW communication protocol, ensuring reliable data trans-mission and secure, low-power operation in challenging environments. The system's low energy consumption is a key feature, with the end-device nodes achieving an average power consumption of 0.57 mA/h, powered by a 4800 mAh battery, providing a projected operational autonomy of 353 days. The results demonstrate that this intelligent system can significantly reduce water wastage while maintaining optimal soil conditions for crops, making it a sustainable solution for precision agriculture.

==========

Mohamed Faouzi Melalkia, Dris Anis Benkhedda, Bachir Madani: *Experimental implementation of vacuum-based quantum random number generator for quantum communication and cryptography protocols*

Abstract

Quantum random number generators represent one of the most promising techniques for producing truly and unique random numbers, essential in many applications such as quantum communication and cryptography protocols. In this work, we report an experimental implementation of vacuum-based quantum random number generator. By measuring the quantum fluctuations of the radiation ground state, a mixture of a perfectly Gaussian distributed random signal originating from the intrinsic randomness in the quantum measurement and an undesired classical electronic noise is obtained. Using an adequate post-processing, the undesired classical contribution of the electronic noise is removed to produce final, quasi-uniformly distributed random bit sequences. The high-quality character of the generated random bits is confirmed by applying the statistical tests of the NIST SP 800-22 test battery.

==========

Abderrahmane Benaissa, Abdellah Kouzou, Said Drid, Khadidja Allahoum: *Improving Grid Stability and Efficiency with V2G/G2V: A Simulation Study of a Bidirectional Power Flow System*

Abstract

This research investigates the challenges of the increasing demand for electricity from EVs can strain the grid, particularly during peak hours. To address this, the paper proposes a Vehicle-to-Grid (V2G) system that allows EVs to both charge (G2V) and discharge (V2G) electricity to and from the grid. This bidirectional energy flow enables EVs to act as distributed energy storage, helping to balance grid demand by storing excess energy during off-peak hours and releasing it when needed. The system relies on a novel bidirectional converter and advanced control algorithms to ensure safe and efficient energy transfer. Simulation results demonstrate the effectiveness of the proposed system in managing energy flow and maintaining grid stability.

Houari Bentoutou, Lakhdar Limam, Zou Ren Wei: *Conceptual Design of Solar Arrays for Geostationary Satellites and Comparative Analisys of Solar Cells for Minimizing Mass and Area*

Abstract

Geostationary satellites have gained significant attention in recent years due to their potential for various applications, including telecommunications and scientific research. The solar panel system is a critical component of their design, which provides the necessary power for onboard systems. The design of the solar panel system requires optimization of factors such as weight, volume, and surface area while ensuring sufficient power generation to meet the satellite's operational requirements. Selecting a solar cell that meets the specific requirements for mass and size is essential for optimizing the solar array. This paper presents the conceptual design considerations of solar arrays using various types of solar cells from different manufacturers. The study compares the advantages and disadvantages of these solar cells, focusing on the total mass and surface area required for the solar array.

==========

Nadia Drir, Adel Mellit: *Improving Defect Classification in Photovoltaic Modules Using CNN with Attention-Based Processing*

Abstract

This paper presents the development of an advanced convolutional neural network (CNN) model that incorporates attention-based processing to enhance defect classification in electroluminescence images. The attention mechanism enables the model to focus on significant regions of the image, thereby improving its ability to capture critical features. By selectively highlighting these regions, the model achieves greater accuracy in identifying subtle defects that may otherwise be overlooked. Unlike traditional CNN approaches, which rely solely on convolutional layers, the proposed model leverages attention to dynamically concentrate on areas of interest, leading to more precise defect classification. The proposed method demonstrates an accuracy of 93%, which represents a substantial improvement over conventional techniques in detecting and classifying diverse defect types in electroluminescence images.

==========

Lynda Chenini, Abdelkader Aissat, Said Nacer, Samuel Dupont, Jean Pierre Vilcot: *Theoretical Investigation of the Influence of Temperature and Indium Composition on Inter subband Absorption in InGaN/GaN QW*

Abstract

We have theoretically studied the structural and optical properties of Zinc Blende (ZB) InGaN single quantum well (QW) grown on GaN substrate with varying indium (In) and temperature (T) values. For this purpose, the indium content was adjusted between 0% and 40%. The eigenvalues and eigen functions of the structure were determined by numerically solving the Schrödinger equation. Both parameters significantly affect various properties of the InGaN/GaN structure such as: strain (ε), band gap energy (Eg), conduction band offset (ΔEc) and the absorption coefficient (α) of the inter subband transitions (ISBT). These findings indicate that the InxGa1-xN/GaN shows potential for developing new devices that use electron inter subband transitions, leading to new possibilities in mid-infrared applications.

Zahra Mokkrani, Djamila Rekioua, Chafiaa Serir, Khoudir Kakouche, Toufik Rekioua, Nabil Mezzai, Adel Oubelaid, Talit Belhoul: *Optimized Energy Management in Hybrid Photovoltaic-Battery-Fuel Cell Systems for Enhanced Sustainability*

Abstract

This study investigates methods for integrating photovoltaic, battery, and fuel cell technologies into hybrid energy systems. Sunlight is transformed into electrical energy using photovoltaic panels, which can then be stored in batteries for later use. When solar energy is insufficient, batteries and fuel cells operate simultaneously, reducing the strain on individual components and extending the overall lifespan of the batteries. The synergy between these elements results in a dynamic and optimized energy management approach. By leveraging the complementary strengths of PV panels, batteries, and fuel cells, these hybrid systems enhance reliability while promoting sustainability. This approach also addresses the limitations of single-source energy systems by mitigating power fluctuations and ensuring continuous energy supply, even in varying environmental conditions. Moreover, the integration of these technologies contributes to reducing the carbon footprint of energy production, aligning with global efforts to transition to cleaner and more resilient energy systems. The study's conclusions demonstrate how hybrid energy systems have the ability to completely transform energy management procedures and provide a workable option for both commercial and residential settings. In addition to maximizing system lifespan, this all-encompassing strategy aids in the creation of a future energy infrastructure that is efficient and sustainable.

==========

Abderrahim Benhamou, Mohamed Tellache: *Waveform Optimization Techniques for Energy Transfer Systems: A Novel Approach to Improving Performance*

Abstract

This article investigates the impact of optimized waveforms (POW) on wireless power transfer (WPT) systems. It examines the main components of the WPT system and their influence on overall efficiency, with a focus on the waveform used and the effect of multipath channels. The RF-DC conversion efficiency (PCE) depends on both internal and external parameters of the RF-DC conversion circuit, particularly the waveform, which plays a crucial role at low power levels. The results show that waveforms with a high peak-to-average power ratio (PAPR) improve the PCE and extend the range compared to conventional sinusoidal waves. However, the propagation channel affects the waves received by the rectifier, thereby influencing the RF-DC conversion. Alterations to the POW during propagation also impact the range and energy efficiency. Lastly, the study focuses on complex non-line-of-sight (NLOS) environments, where optimized waveforms outperform continuous waves (CW) by spreading power across multiple frequencies. This feature makes them better suited to multipath environments, reducing attenuation and interference. These findings highlight the importance of waveform optimization in complex and non-ideal WPT system environments.

Abdul Hafeez, Nasser Al-Emadi, Iqbal Atif, Abdellah Kouzou: *Optimizing Electric Vehicle Demand Forecasting in Electrical Transportation System Using a Hybrid GRU- Self-Attention Framework*

Abstract

The rapid rise in electric vehicle (EV) adoption necessitates efficient forecasting of EVs charging load to ensure stable grid operations and optimized energy source allocation. Existing approaches such as statistical and standalone deep learning models, often fall short in capturing both short-term and long-term dependencies. However, hybrid models demand significant computational resources, necessitating lightweight, forecasting frameworks suitable for edge devices in smart grids. This study introduces a hybrid GRU-Self-Attention model that utilizes Gated Recurrent Units (GRUs) for sequential learning and the self-attention mechanism for long-range dependency capture. The model uses the open-source dataset of EVs charging sessions, and demonstrates superior performance in EVs load demand forecasting. The proposed hybrid model achieves a significant reduction in Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) compared to Long Short-Term Memory (LSTM) and BiLSTM models. This work provides a scalable and efficient framework for EV load prediction and contributes to hybrid architecture for EVs demand forecasting.

==========

Sihem Damkhi, Mohamed-Said Nait-Said, Nasreddine Nait-Said : *High-Frequency Saturation Saliency-Based Modeling of Induction Machine for Sensor less Controle*

Abstract

In this paper, an improved saturation model combined with a high frequency signal injection is proposed. The classical model is not able to analyze the interaction between the low frequency main field and the field generated by high frequency signal injection. To remedy this problem, we introduce in this paper a new saturated induction motor model adopts to describe the phenomena produced by adding high frequency signal. This model contains saturation which is considered as the difference between unsaturated and saturated magnetizing flux. The machine is modeled with two different rotor circuits because due to the saturation the air gap flux contains the fundamental and the third harmonic. In order to describe the effects produced by injection of high frequency signal, a rotating voltage signal is added to normal supply of saturated induction motor. To demonstrate the effectiveness of proposed model the simulation tests are used. The results clearly demonstrate the validity of the proposed model specifically in terms of signal injection and saturation.

==========

Boudour Dabbaghi, Abdellah Kouzou, Faiçal Hamidi, Mohamed Aoun, Houssem Jerbi: *A Method for Estimating the Attraction Basin of Nonlinear Controlled Systems Subject to Actuator Saturation Constraints*

Abstract

This paper proposes a method for estimating the largest domain of attraction for nonlinear systems with saturated inputs. By identifying this domain, the stability of the system can be ensured and the global controlled system's performance can be designed under real-world constraints. Enlarging the attraction domain is critical to designing robust control systems that handle practical scenarios efficiently. This work uses JAYA algorithms and linear matrix inequality conditions to determine the optimal state space that maximizes the estimation of the large region of attraction. To demonstrate the effectiveness of the proposed approach, numerical results and analysis are presented.

Oussama Slimani, Kamel Boudjit: *Implementing a YOLOv5 neural network in systems-on-chips: A comparative study between the NVIDIA SoC and the APSoC-Zynq7000*

Abstract

The aim of this article is to make a comparison between two high-performance maps used to implement convolutional neural networks such as YOLO. We explore two distinct approaches to this comparison. In the first approach, we implement directly on the Pynq-Z1 board by performing several trials and solving various problems that arise. The second approach involves implementing the network on the Jetson Nano board. This method involves first training the model on a main computer and then running it on the embedded system.

Integrating the YOLO algorithm into the SoC presents opportunities to improve the perception and processing capabilities of embedded systems. However, it is important to note that this integration is not without its difficulties and limitations.

In this article, we examine in detail the benefits, difficulties and limitations inherent in this integration. We focus our analysis on two separate development boards: the Pynq-Z1, which is based on an FPGA architecture, and the Jetson Nano, which is equipped with an NVIDIA SoC.

Our ultimate goal is to achieve a comprehensive comparison between the performance of these two boards. We aim to identify the optimal results and determine which approach offers maximum efficiency. In summary, this paper provides an in-depth look at the positive aspects and challenges of integrating the YOLO algorithm into embedded systems using two distinct development platforms.

==========

Ghania Mohand Kaci, Achour Mahrane: *Comparative Study Based on Techno-Economic Feasibility of Individual and Collective Decentralized PV Power Supply Devoted to the Residential Community*

Abstract

In the context of the sustainable energy transition, photovoltaic (PV) appears as a leading option, and microgrids have emerged as a promising option for residential communities, enabling users to meet their energy needs more efficiently while reducing their carbon footprint. This paper presents a comparative analysis of two microgrid configurations to determine which is the most suitable for a residential community. The first configuration is an 'individual' microgrid, where each household has its own PV system and storage. In contrast, the second configuration is a 'collective' microgrid, where a single PV plant coupled with a shared battery bank supplies all households. A technical and economic evaluation was conducted to identify the configuration that best meets the community's energy needs in an optimal manner. The economic assessment is based on three main criteria: Net Present Cost (NPC), Levelized Cost of Energy (LCOE), and Payback Period (PBP). Conversely, the technical analysis is based on two energy performance indicators: self-consumption rate and self-sufficiency degree. The results indicate that the collective microgrid configuration is generally more cost-effective than the individual microgrid. Specifically, this configuration achieves a particularly competitive LCOE of €0.00723/kWh and a relatively short PBP of 12.52 years. However, an individual microgrid may be the more effective option in situations where the houses are geographically distant.

Veronica A. Rosero-Morillo, Francisco Gonzalez, Kouzou Abdellah, Eduardo J. Salazar, Eduardo Orduña: *Real-Time Simulation Environment for High Impedance Faults: Application in OPAL-RT*

Abstract

High-impedance faults (HIFs) in medium-voltage distribution networks represent an ongoing challenge for protection systems, accounting for 5% to 10% of ground faults and posing risks to both electrical infrastructure integrity and public safety. Despite more than four decades of research, HIF detection remains problematic, particularly in modern networks integrating inverter-based resources (IBR), where fault current variability can be mistaken for normal fluctuations or other system events. Conventional overcurrent relays have demonstrated less than 20% effectiveness in detecting these faults. This paper addresses the modelling of HIFs in real-time simulators, explicitly using the OPAL-RT platform, and proposes an optimised model that incorporates the random nature of resistances and DC sources associated with HIFs. A comparative analysis between real-time simulation and off line simulation in Simulink is presented, demonstrating the consistency and accuracy of the implemented model. The results confirm that the optimised model not only accurately replicates theoretical behaviours but also meets real-time execution requirements, thereby contributing to the improvement of protection schemes and fault detection studies in modern distribution systems.

==========

Mohd Tahir, M Saad Bin Arif, Imad Eddine Mohammedi, Abdellah Kouzou: *Single DC-Source Boosted Ouput MLI Inverter Topology for Solar PV Grid Integration*

Abstract

This article presents an improved 13-level Switched-Capacitor Multilevel inverter (SC-MLI) topology integrated with a solar PV system. The circuit utilizes 11 unidirectional switches, one bidirectional, a single DC source, and three capacitors to achieve a triple-boosted output voltage while reducing the total standing voltage (TSV). The capacitor voltages are self-balanced, eliminating the need for auxiliary circuits or sensors, thereby simplifying the design and makes it more suitable for solar PV integration. The feasibility of the topology is tested under dynamic and statics load conditions, ensuring its adaptability to real time applications. A comparative analysis is conducted to evaluate the circuit's switch count, cost, power quality and stresses on the switches during operation. Thermal analysis using PLECS software is carried out to evaluate component losses, heat dissipation, and efficiency, ensuring optimal performance and reliability of the system. The circuit is integrated with PV system, and a PSO-based MPPT controller is used to ensure maximum power operation. The feasibility of implementation for solar PV applications is validated through testing, confirming the topology's effectiveness and suitability for practical use in PV systems.

Evode Rwamurangwa, Annonciata Muhorakeye, Elyse Barahira, Dushimimana, Sylvie Isingizwe : *Grid-PV Hybrid EV Charging Cluster Impact on Distribution Grid*

Abstract

The adoption of Electric Vehicles (EVs) equipped with bi-directional charging stations offers promising prospects for reducing transport-related emissions, enhancing renewable energy storage utilization, and improving distribution grid efficiency. To fully harness the potential of intermittent renewable energy sources, this study proposes the Grid-PV Hybrid Cluster (GPVHC) EV charging stations. These clusters integrate the distribution grid, EVs, and renewable energy sources via a common DC bus, deployed across various urban locations. Positioned in public parking areas, GPVHC stations charge EVs using renewable energy during availability and off-peak periods, while allowing stored energy in EVs to support both transportation and grid supply during peak hours. Although GPVHCs are recognized for their reliability and contribution to green mobility and energy optimization, they present certain challenges. As they are interfaced with the distribution feeder, this work evaluates their impact on the overall performance of the power distribution grid.

==========

Nusaiba Abdulaziz Al Busaidi, Abdullah Al-Badi, Rami Al-Hmouz: *Wind Power Forecast using Machine Learning Approach at Al Duqum Area*

Abstract

The integration of wind energy into power grid requires highly accurate forecasting methods to optimize reliability. Al Duqum area – a coastal town in Oman- has been identified as a strategic site for wind energy development due to its promising wind resource. Given the objective to build a 200 MW wind project in Al Duqum, developing a forecasting model is essential for effective energy management. The existing machine learning forecasting models are generally designed for conditions outside Oman. However, wind patterns vary by region, making it important to develop a model that accurately captures Al Duqum's specific wind behavior. This paper presents a study for number of machine learning-based forecasting methods which could be implemented for the proposed area. The studied methods are Extreme Learning Machine (ELM), Long Short-Term Memory (LSTM) and Random Forest (RF), with formation of different optimized and boosted methods. The proposed approaches consider the historical metrological daily data for the Al Duqum area in addition to the planned wind turbines datasheet for long-term power prediction. The results have indicated a considerable capability of the proposed forecasting models.

==========

Sondess Ben Aoun, Nabil Derbel, Houssem Jerbi: *Fuzzy Secure Control for Singularly Perturbed Systems Against Cyber-Attacks: A Sliding Mode Approach*

Abstract

This paper addresses the problem of cyber-security for nonlinear singularly perturbed systems when false data injection occurs on the sensors and actuators. The interval type 2 (IT2) fuzzy approach is investigated as a suitable model to design a sliding mode controller able to cope with cyber-attacks. To begin with, a switching function is defined, and a sliding mode control (SMC) law is developed to drive the system's state trajectories towards the sliding domain around the sliding surface. Then, the stability and reachability properties are demonstrated using the Lyapunov approach. Moreover, to address nonlinear constraints in the SMC design problem, the dandelion optimization algorithm (DOA) is employed in conjunction with linear matrix inequality (LMI) approach. In the end, a concrete demonstration is conducted to demonstrate the effectiveness of the proposed approach regarding the tunnel diode circuit application.

Karim Ben Si Said, Abdessamad Belhakimi, Samir Chadli, Youcef Remram, Nazim Ouadahi: *Wireless Tensiometer for Soil Moisture Monitoring and Data Telemetry*

Abstract

Soil moisture monitoring is an important aspect of smart irrigation systems, essential for efficient water management and cost savings in agriculture. Tensiometers are highly accurate instruments for measuring soil water tension, making them essential for optimizing irrigation schedules. In this paper, a low cost instrumented tensiometer is presented, featuring a pressure sensor and a conditioning electronic circuit. The device includes wireless communication capabilities using LoRa technology, allowing data to be transmitted to a master node. The master node offers dual functionality: it can upload data to Google Sheets via the internet for cloud-based analysis or display it locally through a Wi-Fi server-client interface. Measurement validation results confirm a strong linear correlation between the measured and reference values, with a slope of 0.9935 and a standard error of 0.00782.

==========

Maroua Bouziane, Laid Zarour, Khaoula Nermine Khallouf: *High Efficiency power control using Type 2 Fuzzy Logic integrated Direct Power Control with Space Vector Modulation*

Abstract

This work is concerned with the study of an progressed direct power control strategy with space vector pulse width modulation (DPC_SVPWM) utilizing a Type-2 Fuzzy Logic Controller (T2FLC), applied to a three-phase, three-level Shunt Active Power Filter (SAPF), The DPC-SVPWM strategy, based on the T2FLC is designed to accomplish the following objectives: goals: maintain the Total Harmonic Distortion (THD) within the limits specified by international norms and ensure operation at unity power factor,. elimination of harmonic currents generated by non-linear loads, compensate for reactive power, and enhance system performance by improving robustness, stability, and reducing response time. Additionally, it minimizes active and reactive power ripples while maintaining a fixed switching frequency. Finally, the developed model is validated under the environment (MATLAB/SIMULINK).